

The dissemination of healthy diet programme; Krachtvoer for Dutch prevocational schools

Citation for published version (APA):

Bessemers, K. M. H. H. (2011). *The dissemination of healthy diet programme; Krachtvoer for Dutch prevocational schools*. [Doctoral Thesis, Maastricht University]. <https://doi.org/10.26481/dis.20111124kb>

Document status and date:

Published: 01/01/2011

DOI:

[10.26481/dis.20111124kb](https://doi.org/10.26481/dis.20111124kb)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

**The dissemination of the healthy diet
programme Krachtvoer for Dutch
prevocational schools**

Layout: Tiny Wouters
Cover: Bilbo Schickenberg, www.bilbos.nl

Printed by: Datawyse / Universitaire Pers Maastricht
ISBN: 978 94 6159 094 7

Copyright Kathelijne Bessems, 2011. No part of this thesis may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage or retrieval system without permission from the author, or when appropriate, from the publishers of the publications.

The work in this thesis was performed within the NUTRIM School for Nutrition, Toxicology and Metabolism, Maastricht University Medical Centre+. This work was supported by the Netherlands Organization for Health Research and Development (ZonMw), grant number 63200011.

The dissemination of the healthy diet programme Krachtvoer for Dutch prevocational schools

Proefschrift
ter verkrijging van de graad van doctor
aan de Universiteit Maastricht,
op gezag van de Rector Magnificus, Prof. mr. G.P.M.F. Mols,
volgens het besluit van het College van Decanen,
in het openbaar te verdedigen
op donderdag 24 november 2011 om 14.00 uur

door

Kathelijne Maria Hubertus Hubertus Bessems



Promotor

Prof. dr. N.K. de Vries

Copromotores

Dr. P. van Assema

Dr. T.W.G.M. Paulussen

Beoordelingscommissie

Prof. dr. G. Kok (voorzitter)

Prof. dr. J.J.H. van den Akker (Universiteit Twente)

Prof. dr. Ir. J. Brug (Vrije Universiteit Medisch Centrum Amsterdam)

Dr. S.P.J. Kremers

Prof. dr. G.D.E.M. van der Weijden

Contents

Chapter 1	Introduction	7
Chapter 2	Appreciation and implementation of the Krachtvoer healthy diet promotion programme for 12- to 14- year-old students of prevocational schools	27
Chapter 3	Healthier food choices as a result of the revised healthy diet programme Krachtvoer for students of prevocational schools: the results of a clustered randomized controlled trial	47
Chapter 4	Examining the relationship between completeness of teachers' implementation of the Krachtvoer healthy diet programme and changes in students' dietary intakes	63
Chapter 5	Evaluation of an adoption strategy for a healthy diet programme for lower vocational schools	77
Chapter 6	Determinants of completeness of teachers' implementation of the Dutch school-based Krachtvoer healthy diet programme	99
Chapter 7	General discussion	115
Appendix A	Definitions	137
	References	141
	Summary	151
	Samenvatting	157
	Dankwoord	163
	Curriculum Vitae	167
	Publications	171

Chapter 1

Introduction

Introduction

Krachtvoer is a Dutch school-based healthy diet programme intended for students in the first and second years of the three highest educational subtracks of Dutch prevocational school. The programme comprises eight class-room lessons administered by teachers care and biology. It aims at increasing the consumption of fruit, achieving a daily healthy breakfast, and decreasing the consumption of fats by replacing high-fat snacks (e.g. chocolate, potato chips) by non-fat or low-fat snacks (e.g. acid drops, chewing gum). The programme was developed and evaluated during a PhD project at Maastricht University, which was completed in 2005 (Martens, 2005). Although the results of short-term effectiveness and process evaluation studies were promising, the project team concluded that there was still room for further improvements to the programme (Martens, van Assema, Paulussen, Schaalma, & Brug, 2006; Martens, van Assema, Paulussen, van Breukelen, & Brug, 2008). Better support for the teachers was recommended to improve programme implementation (Martens, et al., 2006). Also, in order to have public health impact, the programme needed to be adopted, implemented and continued on a large scale by teachers (Durlak & DuPre, 2008; Glasgow, Vogt, & Boles, 1999).

This thesis describes the results of the present PhD project on the Krachtvoer programme. The first aim of the present project was to revise the programme based on the findings of the first evaluation studies and to study the behavioural short- and longer-term effects of this revised programme. The second aim was to systematically develop and evaluate a dissemination strategy for HP professionals from the regional public health services (RPHSs) to support the adoption, implementation and continuation of the programme. This dissemination strategy was implemented by HP professionals from five RPHSs in the Netherlands. The HP professionals were asked to recruit five schools in each of their regions, which were then randomly assigned to the experimental condition, i.e. teaching the Krachtvoer lessons, or the control condition, i.e. teaching their regular nutrition programme. A process and effect evaluation study of the programme were conducted. At the same time, the rate of programme adoption, the completeness of programme implementation and the teachers' intention to continue using the programme, as well as determinants of adoption, implementation and continuation were studied.

The first part of the current chapter starts with a description of the rationale for and aims of the Krachtvoer programme. It continues with a brief overview of the Dutch educational system and the place of nutrition education, and specifically the Krachtvoer programme in this system. Next, it provides a summary of the Health Promoting School, and the place of Krachtvoer

programme within this approach. Then, an outline of history of the Krachtvoer programme is presented, followed by revisions of the programme. The first part of this chapter finishes with an overview of the theoretical foundations of the programme and the programme content. The second part of this chapter presents definitions of a number of terms used in dissemination research, followed by three types of dissemination research. The diffusion of innovation framework used in the current project is presented, followed by a description of the theoretical and practical foundations of the Krachtvoer dissemination strategy and the content of this strategy. This chapter ends with an outline of the studies presented in this thesis.

Part 1 The Krachtvoer programme

Rationale and aims of the Krachtvoer programme

Chronic diseases, such as coronary heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are the leading causes of death and disease burden in Western countries. Around 60% of deaths worldwide, and 46% of the global disease burden, are attributable to chronic diseases, and it is expected that these numbers will continue to rise (World Health Organization, 2003; World Health Organization, 2005). The most important modifiable risk factors for chronic diseases are unhealthy diets, physical inactivity and tobacco use. Unhealthy diets are associated with the majority of chronic diseases, as well as with overweight and obesity (World Health Organization, 2005). Chronic diseases are therefore, to a large extent, preventable by adopting healthy dietary habits from a young age (World Health Organization, 2003; World Health Organization, 2005).

Like other countries, the Netherlands is faced with increasing numbers of people with chronic diseases and overweight or obesity (van den Hurk, van Dommelen, van Buuren, Verkerk, & HiraSing, 2007; World Health Organization, 2003; World Health Organization, 2008). Dietary intakes are among the five main lifestyle issues addressed in current Dutch health policy, and a specific target group is that of young people (Ministerie van Volksgezondheid Welzijn en Sport, 2011). At the start of the present PhD project, another specific target group of Dutch policy was people from lower economic positions (SEP) (Ministerie van Volksgezondheid, Welzijn en Sport, 2006). The Krachtvoer programme focuses on improving dietary intakes among 12- to 14-year-olds of prevocational schools, which have a relatively large proportion of students from lower socio-economic backgrounds.

Targeting nutrition in general is less likely to result in behaviour change than targeting specific nutrition aspects (Contento, 2007; Hoelscher, Evans, Parcel, & Kelder, 2002). The Krachtvoer programme therefore focuses on three aspects of healthy nutrition, namely fruit, breakfast and snack consumption. These behavioural targets were chosen since students can influence these behaviours themselves at (or before) school. Fruit consumption has a favourable effect on the risk of developing cardiovascular diseases and some types of cancer (World Cancer Research Fund & American Institute for Cancer Research, 2007; World Health Organization, 2003), and associated with low energy intake, thus lowering the risk of overweight and obesity. Consuming a healthy breakfast is important to ensure sufficient nutrient intake, which is essential to meet the basic demands of growth and development (Preziosi, et al., 1999; Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). Skipping breakfast is associated with increased levels of high-fat snacking between meals (Sjoberg, Hallberg, Hoglund, & Hulthen, 2003), while daily breakfast consumption is positively related to an overall high-quality diet, a healthier body weight, and better cognitive functioning and school performance (Rampersaud, et al., 2005). Saturated fat intake is associated with the risk of cardiovascular diseases (World Health Organization, 2003), and since snacks are important sources of saturated fat, they can increase the risk of developing obesity and several chronic diseases, such as type 2 diabetes and several types of cancer (Haslam & James, 2005; World Cancer Research Fund & American Institute for Cancer Research, 2007).

The Netherlands Nutrition Centre has formulated practical guidelines for a healthy diet based on guidelines from the Dutch Health Council (Gezondheidsraad, 2006; Voedingscentrum, 2011). The main aims of the Krachtvoer programme are derived from these guidelines and include promoting the consumption of fruit, encouraging the daily consumption of a healthy breakfast, and reducing the consumption of high-fat snacks. More specifically, the consumption of at least two servings of fruit a day is recommended. Additionally, daily breakfast consumption is recommended, including at least a grain product rich in fibre (e.g. wholemeal bread, cereals). With regard to snack consumption, the Netherlands Nutrition Centre recommends that calories taken from snacks between meals should be limited to 300 to 400 calories for 12- to 14-year-olds. Furthermore, preferred snacks, intermediate snacks and snacks that should be eaten only as an exception, are distinguished (Voedingscentrum, 2011). The Krachtvoer programme discriminates the preferred and intermediate snacks from the exceptional snacks, and students are discouraged to consume snacks from the exceptional category.

Unfortunately, not all Dutch youngsters meet these recommendations. The exact deviations from the guidelines are unknown, since no data from recent food consumption studies among representative samples of Dutch 12- to 14-year-olds are available. However, related studies (e.g. effectiveness trials of health promotion interventions, studies among other age groups) imply moderate to large deviations from the dietary recommendations. A European study shows that only 39% of the Dutch 13-year-old girls and 28% of the Dutch 13-year-old boys consume fruit on a daily basis (World Health Organization, 2008). A Dutch study among 12- to 14-year-olds from prevocational schools indicates that students consume on average 0.9 servings of fruit a day (Martens, et al., 2008). With regard to breakfast, Dutch youngsters seem to have less problematic dietary habits. The European study indicates that 75% to 78% of the Dutch 13-year-olds consume breakfast every day, while the European mean for this age group is 54% to 59% (World Health Organization, 2008). Another, more recent, Dutch study among a sample representative of Dutch 10- to 18-year-olds shows that a daily breakfast is consumed by 86% of the Dutch 12- to 13-year-olds and 74% of Dutch 14- to 15-year-olds (Raaijmakers, Bessems, Kremers, & van Assema, 2009). Grain products are consumed at breakfast by 52% of the 12- to 13-year-olds and 44% of the 14- to 15-year-olds. Daily breakfast consumption among 12- to 17-year-olds at prevocational schools is 61% to 79%, while 35% to 46% consume grain products at breakfast. Daily breakfast consumption seems to decrease with increasing age and decreasing educational tracks (Raaijmakers, et al., 2009; World Health Organization, 2008). With regard to snack consumption, another Dutch study found that 52% of the Dutch 12- to 15-year-olds consume snacks more than two times a day (van der Horst, et al., 2008). Another study among 12- to 14-year-olds from prevocational schools indicated that this group consumes around 1.8 servings of snacks a day (Martens, et al., 2008).

Schools are considered an obvious setting for health promotion initiatives, since children and adolescents from all age groups can easily be reached there (Hoelscher, et al., 2002; World Health Organization, 1998). A review by van Cauwenberghe and colleagues (2010) showed a difference between children and adolescents as regards the effectiveness of interventions. The authors found strong evidence for the effectiveness of multicomponent interventions (combining educational aspects with environmental changes, e.g. availability) among children, but limited evidence for effects of stand-alone education-only interventions. For adolescents, the evidence of the effectiveness of educational interventions was moderate, but limited evidence was found for the effectiveness of multicomponent interventions, possibly due to the small number of high-quality effectiveness trials in secondary schools (van

Cauwenberghe, et al., 2010). Nevertheless, others have shown that methods aimed at changing the physical or social environment, such as adopting healthier nutrition school policies or increasing parental involvement, have had promising effects on students' dietary intakes and are recommended for school-based healthy diet programmes (French & Stables, 2003; Jaime & Lock, 2009). The Krachtvoer programme was developed to be implemented as a stand-alone educational programme. To optimize its effects on dietary behaviours, Krachtvoer can be incorporated as a component of a more comprehensive multicomponent whole-school approach, targeting environmental influences as well (Boonen, De Vries, De Ruiter, Bowker, & Buijs, 2009; Contento, 2007; Hoelscher, et al., 2002; Laurence, Peterken, & Burns, 2007).

The Dutch educational system and nutrition education

In the Netherlands, education is compulsory for all children from the age of 4 until 16 years. The Dutch secondary school system, which starts from the age of 12 years, is divided into several educational tracks. Students are directed towards an appropriate educational track according to their abilities and performances. Going from high to low track, the regular secondary education system is divided into pre-university education, senior general education and prevocational education (Ministry of Education Culture and Science, 2007). Prevocational education in turn is divided into four subtracks. The revised Krachtvoer programme is aimed at students from the three highest subtracks of this prevocational education system. Students attending the two lowest subtracks from prevocational schools often come from families with lower SEP (Sociaal Cultureel Planbureau, 2003), which in turn is associated with less healthy dietary habits and higher incidences of overweight (Hanson & Chen, 2007).

In 2006, a new law stipulating the key targets of Dutch secondary education was enacted (Ministerie van Onderwijs Cultuur en Wetenschap, 2006), which provided prevocational and other secondary schools with more autonomy in organizing their teaching, especially in the first and second years. As a consequence of the new law, schools have to concentrate a large part of their first- and second-year curriculum on accomplishing 58 general primary targets. Two of the core targets are broadly related to the topic of nutrition (target 34: teaching students to understand the structure and function of the human body, linking this to physical and psychological health and to taking responsibility for one's own health; and target 35: teaching students about aspects of care and taking care of themselves, others, and their environment; and teaching them to have a positive effect on their own safety and that of others in various situations of everyday life) (Ministerie van Onderwijs Cultuur en Wetenschap, 2006).

Behaviour change in the context of health promotion is, however, not a standard part of the national educational targets. Organizations advocating health promotion at schools thus rely on persuasive communication to convince each separate school in the Netherlands to address health promotion.

The topic of nutrition is included in the school subject called 'care', which focuses on practical knowledge about care, skills (such as cooking) and health education. It is also integrated in the biology curriculum. However, another consequence of the new law is that the subject of care is no longer obligatory. Some schools have therefore eliminated the subject from their curriculum, while others have combined it with biology, chemistry and/or physics. Teachers are free to choose textbooks for their own subject, and some teachers choose to develop their own teaching materials for some of the topics. Most of the existing and self-developed teaching materials aim to increase knowledge, whereas *Krachtvoer* focuses mainly on behaviour change, using theory-informed methods and practical applications.

Krachtvoer in the 'Health Promoting School'

The importance of a more comprehensive whole-school approach has been advocated in recent decades internationally (Kolbe, 1986; St Leger, 2004; World Health Organization, 1998), and in the Netherlands (Bessems, de Ruiter, & Buijs, 2006; Leurs, 2008; Paulussen, Panis, Peters, Buijs, & Wijnsma, 1998; RIVM, 2010). In the Netherlands it is recommended that four aspects of health are incorporated in the school: (a) early identification of risk factors for health problems, (b) health education during lessons, (c) optimizing the physical and social environment at school, and (d) developing a school policy (RIVM, 2010). In order to achieve this integrated approach, known as the 'Health Promoting School', schools should implement the subsequent steps: determining health needs and priority topics based on a school profile, determining methods and activities, developing and implementing a school health promotion plan, and evaluating the health promotion activities and incorporating activities in a school health policy (Boot, van Assema, Hesdahl, Leurs, & de Vries, 2010; RIVM, 2010).

The most important regional advocates for the Health Promoting School in the Netherlands are the RPHSs. RPHSs are regional organizations that are responsible for health promotion, including support for school-based health promotion. A recent study among the 30 RPHSs in the Netherlands found that somewhat more than half ($n=16$) of them were working according to a Health Promoting School approach, sometimes with certain adaptations (Boot, de Jongh, Leurs, & de Vries, 2011) and that around 22% of the Dutch secondary schools implemented at least three of the steps of this approach (Bos, de Jongh,

& Paulussen, 2010). The Krachtvoer dissemination strategy therefore needed to be compatible with this Health Promoting School approach.

Educational programmes, such as Krachtvoer, constitute one of the four main components of the Health Promoting School approach, mainly focusing on health education in lessons. The Krachtvoer dissemination strategy aims at the systematic dissemination of Krachtvoer as a health education component of a whole-school approach such as the Health Promoting School. The guiding principle is that after the initial implementation of the programme, which is relatively uncomplicated to implement, teachers may be more motivated to expand strategies according to the Health Promoting School approach, supported by the RPHS. An important difference between the Krachtvoer dissemination strategy and the dissemination of the Health Promoting School approach is that teachers are the main target group for the relatively uncomplicated Krachtvoer programme, while coordinators and managers at the schools are more closely involved for the more complex Health Promoting School approach.

History of the Krachtvoer programme

The first version of the Krachtvoer programme was initiated by Maastricht University, the Netherlands Nutrition Centre, and the Netherlands Heart Foundation, in an initial PhD project. The project was financed by the Dutch Organization for Health Research and Development (ZonMW) and the Netherlands Heart Foundation. Representatives from the initiating organizations, other national health promoting organizations, research institutes, the educational field, and an RPHS acted as an advisory committee during the programme development in order to develop a programme which was compatible with practice and could be disseminated at national level. The professional design agency LaVerbe was hired to design the programme materials. Key components of the Intervention Mapping procedure were used for programme development (Bartholomew, Parcel, Kok, Gottlieb, & Fernandez, 2011), such as using available empirical and theoretical knowledge, and additional data collection among students, teachers and parents (Martens, Wind, van Assema, & Brug, 2002; Martens, van Assema, & Brug, 2005). In 2001, a cluster-randomized controlled trial was carried out, which showed that the programme was effective in increasing fruit consumption immediately after its implementation (Martens, et al., 2008). No effects were found on breakfast frequency, but some beneficial effects were found among subgroups of students regarding the nutrients they consumed at breakfast. Mixed results for high-fat snack consumption were found in certain subgroups of students. A process evaluation study showed that the programme was appreciated quite well and

implemented with satisfactory levels of completeness (i.e. the proportion of activities proposed by the programme developers that were actually used) and programme adherence (i.e. implementation as intended by the programme developers). However, some improperly implemented or less appreciated programme elements clearly needed revision. Better support for teachers was recommended to improve the completeness and programme adherence (Martens, et al., 2006).

In the present PhD project, the programme was revised in 2007 by the programme initiators from Maastricht University, the ResCon research agency (where the former PhD student had started working), LaVerbe, the Netherlands Nutrition Centre and the National Institute for Health Promotion and Disease Prevention (NIGZ), which has gained experience with the national dissemination of health promotion programmes. The Maastricht University and TNO Quality for Life were project leaders. TNO Quality of Life has gained extensive experience with dissemination research. Again, the project was financed by ZonMW. This time, the Netherlands Heart Foundation was involved in a specific project part (i.e. funding of the Krachtvoer recipe contest and assessment of recipes). This present PhD project also used a linkage group with representatives of Maastricht University, the Nutrition centre, NIGZ, the TNO Quality of Life research institute, the Dutch Heart Foundation, an RPHS and the ResCon research agency. The group advised on programme revision and the systematic dissemination of the programme during the pilot implementation project, as well as on national programme dissemination. All revised programme materials were carefully pretested among students.

The current Krachtvoer programme: theories, determinants, methods and practical applications

The main theory underlying Krachtvoer is the self-management theory (Boekaerts, Rintrich, & Zeider, 2000). Krachtvoer builds on the three phases of this theory, successively raising awareness of personal dietary intakes, proposing solutions to the problem of not meeting dietary guidelines, and setting personal plans for dietary improvement (Martens, et al., 2006; Bessems, van Assema, Martens, Paulussen, Raaijmakers & de Vries, submitted). Furthermore, Krachtvoer uses insights from the Theory of Planned Behaviour (Ajzen, 1991), the Attitude-Social influence-Self Efficacy Model (de Vries, Dijkstra, & Kuhlman, 1988), literature on awareness of dietary intakes (Brug, van Assema, & Kok, 1998; Oenema, 2004) and action planning literature (Sniehotta, 2009). For the initial development of Krachtvoer an additional determinant study was conducted among 12- to 14-year-olds from prevocational schools (Martens, et al., 2005). This study showed that attitudes

and subjective norms were related to the fruit, breakfast and snack consumption. Additionally, self-efficacy was related to fruit consumption, and modelling behaviour of the mother and availability were related to snack consumption (Martens, et al., 2005). Others have found that food availability and accessibility (Rasmussen, et al., 2006), food rules (de Bourdeaudhuij, 1997), awareness on personal dietary intakes (Brug, et al., 1998; Oenema, 2004), modelling by parents (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009; Rasmussen, et al., 2006), intentions to improve dietary intakes, subjective norms towards healthy fruit and breakfast consumption and towards limiting the consumption of high fat snacks, and taste preferences are related to dietary intakes of children and adolescents (McClain, et al., 2009). Although the relation between nutrition knowledge and behaviour is less strong, this determinant is targeted by the Krachtvoer programme, since teachers consider it important to meet the national educational targets. In sum, Krachtvoer focuses on a mixture of these modifiable behavioural determinants, for which changes can be reasonably expected to result from eight healthy diet lessons.

In the first phase of the programme, students learn about the national recommendations for fruit, breakfast and snack consumption (knowledge), and they assess their own fruit, breakfast and snack consumption and compare their own intakes with the national dietary guidelines (awareness). The behavioural change theory-informed methods and practical applications applied in this phase include drawing attention (posters and postcards with three cartoons on the three topics), providing information on national dietary recommendations, using persuasive communication about the benefits of healthy dietary intakes, reflection and feedback on students' personal dietary intakes (writing down personal intakes, comparing own intakes with the recommendations and discussing implications), using active learning (group discussions and games), exposure (tasting healthy products provided in a lunchbox), involving the home environment (discussing the programme and lunchbox at home) and modelling by other students (bringing the lunchbox along to school later on) and using environmental cues (programme posters) (Bessemers, 2010).

In the second phase, students reflect on the personal causes for not meeting the dietary recommendations, and focus on overcoming personal barriers. Targeted determinants are attitudes, social influence (i.e. subjective norms, modelling, pressure and support), self-efficacy and skills, taste preferences and intentions to achieve dietary change. Environmental determinants, such as availability and food rules at home, are targeted only indirectly (i.e. parents are reached through students). The theory-informed methods and practical applications applied in the second phase again include drawing attention,

providing information on healthy recipes, using persuasive communication, using active learning (e.g. knowledge tests on the website, practical activities), exposure (tasting), involving the home environment (take-home bag with healthy food products and a newsletter for parents) and using environmental cues (i.e. posters, note pad). In addition to the theory-informed methods and practical applications of the first phase, the lessons in this phase incorporate reinforcement (providing a book with the winning recipes of the recipe contest, positive feedback by the teacher), guided practice (preparing a fruit shake), and information on the influence of the social environment (incorporating advertising tricks in a self-developed advertisement poster).

The third phase aims at setting specific behavioural change goals and preparing an action plans for dietary improvement (i.e. translating positive intentions into behaviour) using a computer program. Theory-informed methods and practical applications of this phase include principles of goal setting (students preparing a personal behavioural change goal), action planning (students preparing a specific action plan), feedback (the computer program providing students with feedback on their dietary intakes), active learning (putting plans into practice), reflection (class discussions on the success of plans), and modelling and reinforcement (students who have successfully implemented their plan being invited to talk about it in class).

The revision process of the Krachtvoer programme

Before national dissemination of the Krachtvoer programme could be started, the programme had to be adapted to a larger target group, including students from the second (lower) educational subtrack of prevocational schools (so that it would cover three of the four subtracks of prevocational education) and students of non-Dutch ethnicity. To make the programme suitable for students from the lower educational subtrack, suggestions for more practical applications were incorporated in the teacher manual. Experts from the NIGZ and Netherlands Nutrition Centre advised on including information on multicultural foods and dietary habits to the programme to make it appealing to students of non-Dutch ethnicity. Because of some unfavourable programme effects on students with more favourable baseline dietary intakes (Martens, et al., 2008), the programme needed to be adapted for them as well. These students were given specific tasks, such as providing tips to others. Lastly, since programme materials become rapidly outdated, photos of students and food products were replaced by new ones and the lay-out of the materials was updated. Based on the students' preferences expressed during the pretests the materials were produced full-colour.

Specific revisions to the content of the lessons were also introduced, based on the findings of the RCT and the process evaluation of the first edition of the programme (Martens, et al., 2006; Martens, et al., 2008). The process evaluation of the first edition of *Krachtvoer* revealed that teachers wanted more information on nutrients to be included. An optional pre-programme lesson with general information on nutrients (lesson 0 on nutrients) was therefore added to the programme. The content of the lessons on creating awareness (lesson 2 on fruit and fruit juices and lesson 3 on breakfast and snacks) was presented in a more compact form, since students and teachers found it too detailed. The content of the lesson on social influence (lesson 6 on advertisements) was revised, because the reflective content of the lesson in the first programme edition was considered too difficult. Lastly, an online prestructured computer program generating action plans was developed for use in the lesson on translating positive intentions into behaviour (lesson 7), as the reflective strategies applied in the first version were considered boring and intrusive, and were poorly implemented.

The revisions were made according to a revision plan (Martens, Bessems, & van Assema, 2007), based on the results of the evaluations of the first version of the programme, as well as an updated literature study, findings from interviews with developers of other Dutch health promotion programmes and additional research among students. The first additional study involved five focus group interviews with students to discuss the lay-out of the old programme materials. Suggested changes included the use of full-colour materials, changing the size and composition of some materials, and updating photos of products and students used in the programme materials (Martens, et al., 2007). The second additional study involved ten focus group interviews with students, discussing the content of the messages offered by the lesson on action planning (Raaijmakers & Bessems, 2008). Beliefs, barriers and suggestions mentioned during these focus group interviews were incorporated into the action plan computer program. Five teachers each pretested one or two revised lessons in a total of eight classes, while observed by the programme developers. Results indicated that students and teachers responded well to the adjusted lessons. Some final suggestions were incorporated into the new version of the lessons. This thorough process of adjustment led to the current *Krachtvoer* programme.

Overview of the current Krachtvoer programme

As mentioned the *Krachtvoer* programme comprises eight class-room lessons and is aimed at increasing the consumption of fruit, achieving a daily healthy breakfast, and decreasing the consumption of fats by replacing high-fat snacks

(e.g. fried snacks, chocolate, potato chips, cookies) by non-fat or low-fat snacks. The programme consists of fixed lessons and optional activities. The main instrument is the student workbook, which includes information sheets, activity sheets and question sheets. These three types of sheets provide students with information (e.g. on the national recommendations for fruit intake), encourage them to engage in practical activities (e.g. preparing a fruit shake), and to answer questions (e.g. on personal reasons for their own dietary intakes or decisions). The programme is supported by a teacher manual, posters, postcards, a lunchbox with a flyer and healthy food items, a magazine, a recipe contest, a website (with information, knowledge tests, recipes), and a take-home bag with a notepad, healthy products and a newsletter for parents with tips and recipes. Many of the materials feature three cartoon characters related to the targeted behaviours. A programme overview is given in Figure 1.1.

Figure 1.1 The Krachtvoer programme

Lessons

The programme covers 8 lessons and one optional pre-programme lesson on nutrients. Some slots in the lessons 4 to 8 can be filled by 7 optional activities (of which at least 2 should be used).

- Before the start of the programme:
 - Lesson 0: Nutrients. Students learn about nutrients (e.g. saturated fats, carbohydrates), their functions in the human body, and food products containing these nutrients
- Phase 1. Students are made aware of their own dietary intake and deviations from the Dutch dietary guidelines.
 - **Lesson 1: Nutrition, foods and health.** Students' knowledge on fruit, breakfast and high-fat snacks is tested in a quiz. Students receive a lunchbox with a flyer and three healthy food items representing the three topics.
 - **Lesson 2: Fruit and fruit juices.** Students learn to read fruit juice labels. Knowledge about the differences between fruit juices and other juices is tested with a fruit juice test. They are made aware of their own fruit or fruit juice consumption, and become familiar with national recommendations.
 - **Lesson 3: Breakfast and snacking.** Students are made aware of their own breakfast habits and high-fat snack consumption. The disc of five and an overview of low- and high-fat snacks are discussed and compared with their own breakfast and snack intakes.

Figure 1.1 continued

- Phase 2. Students specify reasons for deviations and are encouraged to propose solutions.
 - **Lesson 4: Barriers to healthy eating.** Students answer questions on personal reasons for (not) meeting the dietary recommendations on fruit, breakfast and snack intakes, and give each other tips on healthy eating. Students receive a take-home bag with healthy products, a newsletter with tips and recipes, and a notepad designed to involve their parents.
 - **Lesson 4 (part 2) – lesson 7 (part 1)**
 - **National recipe contest.** Students participate in a national recipe contest.
 - **Magazine.** Students work with a magazine offering information, tests, puzzles, a horoscope, role model stories and healthy recipes.
 - **Website.** Students visit the Krachtvoer website to read information, do a snack test (i.e. distinguishing between high- and low-fat snacks) and a knowledge test (e.g. practical and theoretical knowledge about fruit, breakfast and snacks), and send e-cards.
 - **Lesson 5. Food exposure.**
 - **Taste testing.** Students judge products by tasting, smelling and looking at (unfamiliar) fruit, breakfast products and favourable snacks.
 - **Fruit tasting.** Students bring fruits from home to school and taste them together.
 - **Preparing a fruit shake.** Students prepare a healthy tasty fruit shake
 - **Lesson 6. Advertisements.** Advertising tricks are discussed and are applied in an advertising poster produced by the students.
- Phase 3. Students implement and evaluate an action plan.
 - **Lesson 7 part 2: Personal action plans.** Students use a program on the website to generate a personal action plan (what, when, where) to improve their fruit, breakfast or snack intake during the next week.
 - **Lesson 8: Evaluation of personal plans.** In-class evaluation of the action plans, followed by an optional activity.

Programme materials

Students' workbook, posters, postcards, a lunchbox with healthy food items, a magazine, a website with a computer program for action plans, a take-home bag for parents, containing a newsletter and healthy food items, a recipe contest and a teacher manual.

Part 2 Dissemination of Krachtvoer

Dissemination research: definitions and relevance

By some the terms diffusion and dissemination have been used interchangeably in the literature. In this thesis diffusion is defined as the unplanned spread of an

innovation, while dissemination refers to the systematic planned overall process of adoption, implementation and continuation of an innovation (Appendix A). Adoption refers to the decision of a person or organization to make full use of an innovation. Implementation refers to the actual use of an innovation. Two important aspects (of the fidelity) of programme implementation are adherence and completeness. Continuation or sustainability refers to the degree to which an innovation is continued over time after a dissemination programme ends (Rogers, 2003).

Although a lot of research has examined the effectiveness of health promotion efforts in practice, relatively little research has been done on the planned large-scale dissemination of health promotion initiatives (Oldenburg, Sallis, Ffrench, & Owen, 1999). However if effective programmes are not adopted on large scale, implemented with high levels of fidelity, and continued at long term, possible effects may be limited (Glasgow, et al., 1999).

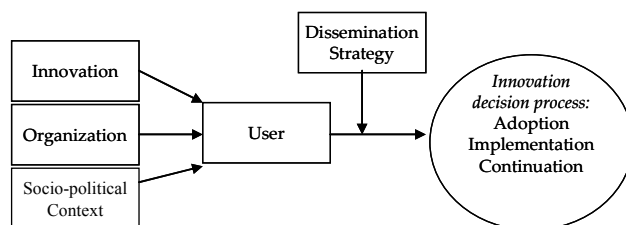
Dissemination research aims to provide insight in several aspects of dissemination processes. It includes research on determinants of dissemination, studies on the actual development and evaluation of strategies to enhance dissemination and research on the relation between implementation and intervention outcomes. Research into determinants of programme dissemination can help us develop and evaluate dissemination strategies (Dusenbury, Brannigan, Falco, & Hansen, 2003; Han & Weiss, 2005). Research generating successful dissemination strategies directly bears fruit for public health practice and programme impact. Research on the relation between aspects of implementation (e.g. dose delivered, adherence) and the effectiveness of interventions (Durlak & DuPre, 2008) can provide in-depth information about reasons why a programme fails to achieve its targets, for example because of incorrect implementation, also known as type 3 error (Dobson & Cook, 1980). Outcomes of dissemination research are therefore essential both for the academic field and for public health practice (Glasgow, Lichtenstein, & Marcus, 2003; Green, Ottoson, Garcia, & Hiatt, 2009; Rohrbach, Grana, Sussman, & Valente, 2006). The current pilot implementation project included all three types of dissemination research.

Diffusion of innovation framework

The main framework underlying all types of diffusion research presented in this thesis, is the diffusion of innovation framework which was developed by Paulussen and colleagues (Paulussen, Kok, & Schaalma, 1994; Paulussen, Wiefferink, & Mesters, 2007). The framework has been used in a number of empirical studies in Dutch health care (Crone, et al., 2006) as well as in the

Dutch educational sector (Hoekstra, ter Beek, Wiefferink, & Buijs, 2007; Wiefferink, et al., 2005). The framework is presented in Figure 1.2.

Figure 1.2 Theoretical framework, based on Paulussen, Wiefferink, and Mesters (2007)



According to this framework, the process of adoption, implementation and continuation is influenced by characteristics of the innovation itself, characteristics of the adopting organization and characteristics of the socio-political context. The relations between these characteristics and the innovation decision process are mediated by characteristics of the user, while the relation between the characteristics of the user and the innovation decision process is moderated by the characteristics of the dissemination strategy (Paulussen, et al., 2007). The specific relevant characteristics depend on the setting. For Krachtvoer examples of characteristics of the innovation were programme-related characteristics, such as compatibility of Krachtvoer with the teaching subject of biology or care, and the complexity of the interactive learning activities. Characteristics of the organization included school-related characteristics such as school size, the students' dietary intakes and the students' appreciation of the programme. Examples of characteristics of the socio-political context included the new Dutch law on educational targets (Ministerie van Onderwijs Cultuur en Wetenschap, 2006), while examples of user-related characteristics included the teachers' professional experience and self-efficacy. Finally, examples of characteristics of the dissemination strategy were the person-to-person approach used by the HP professionals to recruit teachers, and the dissemination handbook designed for the HP professionals. According to the framework all of these characteristics influenced the innovation decision process, including the adoption decision, which is the teachers' decision to work with Krachtvoer or to reject it; the level of implementation (the level of completeness and adherence by which the teachers teach the lessons to students); and the continuation, which is the use of Krachtvoer in the next school year or not.

Theoretical and practical foundations of the Krachtvoer dissemination strategy

Based on theoretical framework a draft of the Krachtvoer dissemination strategy was made. Additionally, insights from the Diffusion of Innovation Theory (Rogers, 2003), the Theory of Planned Behaviour (Ajzen, 1991) and the Social Cognitive Theory (Bandura, 1986) were used, as well as insights into innovations in the educational field (Fullan, 2001). Also, findings from a literature study on recommended strategies for programme adoption, implementation and continuation were followed (Figure 3). Two recently applied dissemination strategies, one for a Dutch sex education programme (Wiefferink, et al., 2005) and one for a Dutch anti-bullying programme (Hoekstra, et al., 2007), provided a practical basis.

Figure 1.3 Overview of essential elements of a dissemination strategy derived from the literature

Phase	Essential elements based on recommendations from the literature
Programme adoption	<ul style="list-style-type: none"> - person-to-person approach by a change agent - including relevant programme information in adoption materials (i.e. programme instrumentality, relative advantage, compatibility, and testimonies of teachers) - involving key decision makers
Programme implementation	<ul style="list-style-type: none"> - involving users in programme development - teacher training (e.g. providing information on core programme elements, increasing self-efficacy, using modelling and stimulating favourable teacher attitude) - achieving ongoing support from/ contact with a change agent - building a favourable school climate (supportive coordinator(s), colleagues, students and a programme champion)
Programme continuation	<ul style="list-style-type: none"> - conducting a programme evaluation - obtaining support from school management - anticipating the broader context in the school (e.g. whole-school approach) - obtaining funding and developing district policies mandating prevention

Strategies derived from literature (Bartholomew, et al., 2011; Beets, et al., 2008; Blake, et al., 2005; Brink, et al., 1995; Buston, Wight, Hart, & Scott, 2002; Butler, et al., 2008; Dowda, et al., 2005; Durlak & DuPre, 2008; Dusenbury, et al., 2003; Gingiss & Boerm, 2009; Gregory, Henry, & Schoeny, 2007; Han & Weiss, 2005; Hoelscher, et al., 2004; Hoelscher, et al., 2001; Jourdan, Mannix McNamara, Simar, Geary, & Pommier, 2010; Kealey, Peterson, Gaul, & Dinh, 2000; Leurs, Bessems, Schaalma, & de Vries, 2007; McBride, Farrington, & Kennedy, 2007; Noonan, et al., 2009; Parcel, et al., 1995; Roberts-Gray, Solomon, Gottlieb, & Kelsey, 1998; Rogers, 2003; Rohrbach, et al., 2006; Sy & Glanz, 2008; Wiefferink, et al., 2005).

In order to identify any salient barriers to dissemination in advance, the draft of the dissemination strategy was discussed with 10 HP professionals and 11 teachers. The draft strategy was perceived to be compatible with current practice, and only minor changes were made (Bessems, 2007).

The content of the dissemination strategy

As mentioned earlier, the dissemination strategy was designed to be used by HP professionals of Dutch RPHSs. The dissemination strategy consists of three sub-strategies, each targeting one of the critical phases of teachers' decision making about innovations: adoption, implementation and continuation (Paulussen, et al., 2007; Rogers, 2003). A dissemination handbook guided the HP professionals in carrying out the steps of the adoption, implementation and continuation phases, and includes supporting instruments such as presentations, checklists and background information. A one-day training course for HP professionals preceded each phase. In the training course the programme was discussed, skills were practiced, feedback was provided, and the HP professionals brainstormed about possible problems and solutions.

The adoption part of the dissemination strategy implied that the HP professionals had to familiarize themselves with the Krachtvoer materials and the dissemination strategy. Next, they had to examine the present situation (e.g. contacts with schools), and try to obtain information about other healthy diet programmes of their RPHS and other organizations. They were asked to write a project plan with specific tasks and a time schedule for the dissemination of the Krachtvoer programme, and to inform colleagues about the programme or involve them in the recruitment effort. The actual recruitment tasks included finding out which teachers and school coordinators should be contacted at each school. Teachers and school coordinators had to be sent a recruitment letter and a recruitment brochure, with background information about the programme, quotes from other teachers about positive experiences with the programme, information about relative advantages of the programme (e.g. students' experiences with the programme, information on programme effectiveness, behavioural change goals, flexibility, active learning methods) and programme compatibility (e.g. information on how the programme could replace some regular lessons from the most commonly used textbooks, and the programme's compatibility with the national educational targets). The HP professionals were asked to visit schools which were interested in the programme. There they had to use persuasive communication and modelling stories from others, and show the programme materials to create enthusiasm for programme adoption. Further they had to provide additional information on the studies accompanying the pilot implementation project. If a school agreed to

participate, the HP professional had to send a participation agreement, which needed to be signed by a coordinator at the school. Although the coordinators had to agree to adopt the programme, it was the teachers who were the main adopting unit, since they implemented the lessons in their classes, without interference from others.

The implementation strategy suggested that the HP professionals organized a two hour kick-off meeting for teachers in their region. At this meeting, they had to inform the teachers about the theory-informed methods and practical applications, and the possibility to contact the HP professional or teachers from other schools in case of difficulties. The HP professionals had to use persuasive communication and modelling stories about others to create enthusiasm for first-time as well as continued programme implementation, and had to stimulate teachers to discuss the programme with others in the school, and create enthusiasm for the whole-school approach. During the weeks in which the teachers implemented the programme, the HP professionals had to contact them by e-mail or telephone to check if the implementation was going well, emphasize again that teachers could contact them in case of difficulties, and check whether teachers had discussed the lessons with colleagues and coordinators.

The continuation strategy involved HP professionals planning an evaluation and continuation meeting with each school. The HP professionals were instructed to mobilize support for longer-term programme implementation by inviting all teachers involved, as well as any coordinators who were involved. The HP professionals had to evaluate the programme with the school, and give advice about programme continuation. Depending on whether the RPHS worked according to the Health Promoting School approach, each HP professional was asked to give advice on integrating the programme into school policy or expanding it to link up with other programmes and obtain a more integrated whole-school approach.

Outline of the thesis

Chapter two presents a study of the appreciation of the programme by students and teachers, the completeness of the programme implementation and adherence to the programme, and the relation between the completeness of programme implementation and programme appreciation. Data were collected by means of students' evaluation forms, teacher logbooks and telephone interviews, as well as classroom observations. *Chapter three* reports on a randomized controlled trial studying the short- and longer-term intervention effects of the revised Krachtvoer programme on students' consumption of fruit, fruit juice, breakfast and snacks. This was examined for the total target group as well as for particular subgroups of students, using self-administered written questionnaires. *Chapter four* includes a study of the relation between short- and longer-term programme outcomes regarding fruit, breakfast and snack consumption, in relation to the completeness of programme implementation and the completeness of implementation of specific programme elements. In *Chapter five* an evaluation study of the Krachtvoer adoption strategy is presented. Interviews were held with the HP professionals of the five RPHSs involved, about their adherence to and evaluation of the adoption strategy. Additionally, the adoption rate was calculated. Telephone interviews with adopting and rejecting teachers were held to identify reasons behind adoption decisions. *Chapter six* reports on the results of a study among the teachers in the experimental condition who had implemented Krachtvoer, on teacher-related, Krachtvoer-related, context-related (i.e. school, student and parents) and dissemination strategy related determinants of the completeness of teachers' programme implementation and their intention to continue using the Krachtvoer programme in the next school year, using self-administered written questionnaires. *Chapter seven* includes a discussion of the results and methodological considerations. The chapter provides an overview of the efforts undertaken to realize the national dissemination of the programme. It further outlines the implications for practice related to further revisions of Krachtvoer, the Krachtvoer dissemination strategy, and proposes changes in the socio-political context. It then discusses the theoretical considerations and implications. The chapter then proposes further research related to Krachtvoer, to intervention and dissemination research in general, and proposes how the methodological considerations could be handled. The chapter ends with a final conclusion.

Chapter 2

Appreciation and implementation of the Krachtvoer healthy diet promotion programme for 12- to 14- year-old students of prevocational schools

Bessems KMHH, van Assema P, Martens MK, Paulussen TGWM, Raaijmakers
LGM & de Vries NK

Awaiting final decision on submitted manuscript

Abstract

Krachtvoer is a school-based healthy diet programme, developed in 2001 and revised in 2007 to meet the needs of particular segments of the target population as well as a wider target group. The main aims of the present process evaluation of the revised programme were to examine student and teacher appreciation of the programme, completeness of and adherence to its implementation, and relations between appreciation and completeness of implementation. Data were collected among 22 teachers and 1117 students of 13 schools, using student evaluation forms, teacher logbooks, telephone interviews, and classroom observations. Results indicate favourable levels of teacher and student appreciation for the programme in general and the revised elements. Girls, first-year students and students with more favourable dietary intakes particularly appreciated individual programme elements. Levels of completeness of implementation were high, but several teachers did not adhere to the intended implementation period. Some moderately strong relations were found between teacher appreciation and completeness of implementation scores. We conclude that the revisions have resulted in a programme that was appreciated well, also by the extended target group, and was implemented with a high degree of completeness. Teacher appreciation proved potentially important for completeness of implementation. We identified several aspects requiring improvement, indicating the importance of continued programme updates and repeated evaluation.

Background

The Dutch Ministry of Health aims to stop the increase in chronic diseases and obesity, for instance by means of behavioural change programmes to achieve healthier lifestyles, including healthy dietary intakes (Ministerie van Volksgezondheid Welzijn en Sport, 2008). Specific target groups of the Dutch policy are young people and people with lower socio-economic positions (SEP), since their lifestyles are less healthy than those of their peers with higher SEP (Hanson & Chen, 2007; Ministerie van Volksgezondheid Welzijn en Sport, 2006; van Kreijl, et al., 2004).

Krachtvoer is a Dutch school-based healthy diet programme for first-year and second-year students of prevocational schools. The programme consists of eight lessons, including fixed lessons (i.e. lessons with a fixed protocol) and optional activities. The main aims are to increase the intake of fruit, to promote the daily consumption of a healthy breakfast, and to reduce the consumption of high-fat snacks. The first version of the programme was launched among 11 secondary schools in 2001. It had been developed using key components of the Intervention Mapping procedure (Bartholomew, et al., 2011), including the use of available empirical and theoretical knowledge, and additional data collection among users. The programme had some beneficial effects on students' dietary intakes, but also some undesirable effects among students with favourable pre-programme intakes (Martens, et al., 2008). It was appreciated quite well and was implemented with satisfactory levels of completeness and adherence. However, some improperly implemented or less appreciated programme elements clearly needed revision. Better guidance for teachers was recommended to improve programme implementation (Martens et al., 2006).

Before nationwide dissemination, the programme needed to be revised, partly to meet the specific needs of particular segments of the target population, including students from a lower subtrack of prevocational education. In 2007 a revision plan was designed, based on the evaluations of the first version of the programme (Martens, et al., 2006; Martens, et al., 2008), a new literature study and interviews with researchers of other health promotion programmes. Programme revisions were introduced and drafts of the revised materials were pre-tested among teachers and students. The revised programme was implemented and evaluated in a randomized controlled trial (RCT). The current paper describes the process evaluation of the revised programme.

Process evaluations are recommended to evaluate a programme's compatibility with the target population and the fidelity of programme implementation (Steckler & Linnan, 2002; Windsor, Clark, Boyd, & Goodman, 2004). Two aspects of fidelity of programme implementation include adherence

(is the programme implemented as intended by its developers?) and completeness (what proportion of activities have actually been implemented?). The first goal of the current study was to examine the appreciation of the programme among students and teachers. More specifically, we investigated if the programme revisions had resulted in greater programme appreciation. Since the programme had been revised to suit the needs of students of a lower subtrack of prevocational education, as well as students of non-Dutch ethnicity and students with more favourable dietary intakes, we were interested in the relation between these characteristics and the appreciation of the programme. Additionally, we investigated if programme appreciation was related to gender, year (first or second) and SEP. The second goal of the study was to assess the completeness of implementation of specific programme elements and the programme adherence. Finally, we examined the relation between programme appreciation and programme completeness. We wanted to find out if the qualitative findings of the first process evaluation, which indicated that programme appreciation among teachers might be related to the completeness of implementation (Martens, et al., 2006), could be confirmed.

Methods

The revised Krachtvoer programme

The Dutch secondary education system is divided into pre-university education, senior general education and prevocational education. Prevocational education in turn is divided into four subtracks. The revised Krachtvoer programme is aimed at students from the three highest subtracks (whereas the previous version was aimed at the two highest subtracks only). The eight lessons are intended to be taught by a school teacher in a specific order within six to ten weeks. Programme activities can be taught in single (45 to 50 minutes) or two-period lessons (90 to 100 minutes), and may be combined with regular teaching materials.

The programme builds on the three phases of self-management theory (Boekaerts, Rintrich, & Zeider, 2000), successively aimed at raising awareness about personal dietary intakes, proposing solutions for not meeting the Dutch dietary guidelines, and setting personal goals for dietary improvement (Martens, et al., 2006). Additionally, it uses insights from the Theory of Planned Behaviour (Ajzen, 1988; de Vries, Dijkstra, & Kuhlman, 1988) the Attitude-Social influence-Self-Efficacy Model (de Vries, et al., 1988), and action planning literature (Sniehotta, 2009). Some examples of theory-based methods we used are goal setting and feedback.

The main instrument is the student work book, which includes information sheets (e.g. with information about the national recommendations for fruit intake), question sheets (e.g. with questions on students' own fruit intake), and activity sheets (e.g. describing a fruit shake preparation activity). The programme is supported by a teacher manual, posters, postcards, a lunchbox with a flyer and healthy food items, a magazine, a recipe contest, a website (with information, knowledge tests, and recipes), and a take-home bag with a note pad, healthy products and a newsletter with tips and recipes. Many of the materials feature three cartoon characters related to the targeted behaviours. A programme overview is given in Table 2.1.

Table 2.1 Overview of the Krachtvoer programme

Phase	Lesson number and topic	Content in short	Supportive materials
1	Prior to the lessons	Students receive one of three different postcards designed to introduce the programme name, the three cartoon characters representing the three topics, and the programme website. Posters matching the design of the postcards are put up in the classroom.	Postcards Posters
	0 Nutrients <i>Pre-programme optional lesson</i>	A general lesson on nutrients (fats, saturated fats, carbohydrates, proteins, fibres, minerals and water), their functions in the human body, and food products containing these nutrients.	Workbook
	1 Nutrition, foods and health <i>Fixed lesson</i>	Different types of knowledge (e.g. theoretical, applied knowledge) are tested in a quiz about fruit, breakfast and low-fat snacks, to make students enthusiastic about the programme. The quiz can be done at home with the parents as well. Students receive a lunchbox with a flyer and three healthy food items representing the three topics of fruit, breakfast and healthy snacking.	Workbook Lunchbox
	2 Fruit and fruit juices <i>Fixed lesson</i>	Photos of fruit juices and product labels are used to help students distinguish fruit juices from sugared fruit juices. Knowledge about the differences between fruit juices and other juices is tested with a fruit juice test in the workbook or on the website. Writing down their own fruit consumption and being provided with information about the national recommendations makes students aware of their own fruit intakes compared to the recommendations.	Workbook Website

Table 2.1 continued

Phase	Lesson number and topic	Content in short	Supportive materials
2	3 Breakfast and snacks <i>Fixed lesson</i>	Writing down their own breakfast consumption makes students aware of their own breakfast intakes. Students can compare their own breakfast with the national recommendations for a healthy breakfast consisting of five food groups (the 'disc of five'). Writing down their own snack consumption makes students aware of their own snack intakes. An overview is given of low- and high-fat snacks, which they can compare to the snacks they regularly consume.	Workbook
	4 (First part) Barriers to healthy eating <i>Fixed lesson</i>	Students answer questions on personal reasons for meeting or not meeting the dietary recommendations on fruit, breakfast and snack intakes. Students give each other tips on healthy eating. Students receive a take-home bag with a notepad, healthy products, a newsletter with tips and recipes and a notepad to involve their parents.	Workbook Take-home bag
	4 (second part) to 7 (first part) Skills and knowledge <i>Optional activities (teacher can choose one or more)</i>	National recipe contest: students participate in a national recipe contest. Magazine: students work with a magazine offering information, tests, puzzles, a horoscope, role model stories and healthy recipes. Website: students visit the Krachtvoer website to read information, to do a snack test (i.e. distinguish high- and low-fat snacks) and knowledge test (e.g. practical and theoretical knowledge about fruit, breakfast and snacks), and send e-cards.	Workbook Website Magazine
	5 Food exposure <i>Optional activities (teacher can choose one or more)</i>	Taste testing: students judge products by tasting, smelling, and looking at (unfamiliar) fruit, breakfast products and healthy snacks. Fruit tasting: students bring fruits from home to school and taste them together. Preparing a fruit shake: students prepare a healthy tasty fruit shake.	Workbook Fruit juice, breakfast and low-fat snack products Products required to prepare a fruit shake
	6 Advertisements <i>Fixed lesson</i>	Advertising tricks are discussed and tricks are applied in an advertising poster produced by students.	Workbook
3	7 (second part) Personal action plans <i>Fixed lesson</i>	Students use a programme on the website to generate a personal action plan (what, when, where) to improve their fruit, breakfast or snack intake during the next week.	Workbook Action plan computer program
	8 Evaluation of personal plan <i>Fixed lesson</i>	The implementation of the action plans, difficulties encountered and possible solutions are discussed in class.	Workbook

Programme revisions introduced in the new version of Krachtvoer included the addition of tips to the teacher manual on the use of practical strategies for students of the lower educational subtrack, the addition of information on foods and dietary habits from other cultures for students of non-Dutch ethnicity, the inclusion of assignments for students who are already eating a healthy diet, and updating the lay-out, size and composition of the materials. Specific changes to the lessons included the addition of a pre-programme optional lesson with information on nutrients. In addition, three lessons on awareness of one's own dietary intakes from the previous version were combined into two new lessons (phase one), the content of the lesson on advertisements was changed (phase two) and the lesson on formulating goals was substituted by an action plan computer program (phase three). A dissemination strategy was developed, consisting of a handbook and a training course for health promotion professionals, to help them recruit teachers to work with the programme, organize a two hour kick-off meeting for the teachers, advise the teachers during programme implementation, evaluate the implementation and contribute to programme continuation in the schools (Bessems, et al., 2011).

Data collection and measures

The current study was part of an RCT. The study was exempt from ethical review according to Dutch regulations. Multiple data collection methods were used for the process evaluation, viz., student evaluation forms, teacher logbooks, classroom observations, and telephone interviews with teachers. Thirteen schools with 53 classes and 1117 students participated in the study. Students were invited to complete the student evaluation forms in the classroom directly after programme implementation. If students objected they were allowed to do another task during the lesson. All 22 teachers who taught the Krachtvoer programme were asked to complete the teacher logbook directly after each lesson. Five randomly selected teachers were approached and asked to give permission for the researcher to observe one to four of their lessons, and six other teachers were contacted for a telephone interview about adherence to the programme directly after implementation.

Student appreciation was measured by the student evaluation forms. One item assessed overall programme appreciation by asking the students to rate the programme on a scale of 1 to 10. In addition, students were asked to allocate separate ratings to five supportive programme materials (the lunchbox, take-home bag, postcards, posters, and website), and three fixed lessons and five optional activities which had undergone major revisions. Students only

answered questions on programme elements which had actually been implemented by their teacher.

Teacher appreciation was measured by means of the teacher logbook, completed after each lesson. Mean total appreciation scores were calculated for the fixed lessons (or components thereof), the optional activities, and the supportive materials.

Completeness of implementation was also assessed by means of the teacher logbooks. The numbers of fixed lessons (or components thereof), optional activities, and supportive materials actually implemented or used were assessed with questions asking whether each of these elements had been implemented. If teachers had not taught a specific lesson or optional activity, they were invited to clarify their reasons for not doing so. Completeness of implementation of five fixed lessons (or components thereof) and four optional activities was calculated as the sum of activities that teachers had ticked as implemented on a list of all proposed activities in each fixed lesson or optional activity, divided by the total number of possible activities in each lesson or optional activity (range 0 to 1). These scores could not be calculated for two of the lessons and three optional activities, since they consisted of one activity only. Total mean completeness scores for fixed lessons and optional activities were calculated as well.

Adherence to the programme was measured by two items in the teacher logbook, i.e., whether the proposed order of the lessons had been adhered to (yes/no) and how long the implementation period had lasted. Teachers were invited to clarify any deviations from the proposed programme. Additionally, a researcher completed structured forms on implemented activities, additional materials used and teaching procedures during the classroom observations. Finally, deviations from the intended programme implementation were discussed in the telephone interviews with teachers.

Student and teacher characteristics

Additional data were available on background characteristics of the students, viz. age, gender, country of birth of both parents and postal code of the home address. Ethnicity was defined as non-native (non-Dutch) if at least one of the parents had been born abroad (Keij, 2000). Postal code was used as an indicator of the neighbourhood's SEP (Sociaal Cultureel Planbureau, 2006). School-related characteristics included whether students were in the first or second year, the educational level of the class (lower [second subtrack] or higher [third and fourth subtracks]). Additionally, pre-programme food frequency data were derived from items in validated questionnaires (van Assema, Brug, Ronda, & Steenhuis, 2001; van Assema, Brug, Ronda, Steenhuis, & Oenema, 2002), viz. the

number of pieces of fruit eaten per day, the number of times a day that high-fat snacks were consumed and the number of days a week on which breakfast was consumed. Available teacher characteristics included gender, teaching experience, and subjects taught.

Statistical analyses

Statistical analyses were conducted with PASW Statistics 17 (SPSS Inc. Chicago, IL).

Descriptive statistics were used to analyse participant characteristics and scores on outcome variables. Subgroups of students based on general programme appreciation and appreciation of specific programme elements were distinguished using backward regression analyses correcting for gender, year (first or second), educational track, SEP, ethnicity, and food intakes, using a 0.05 significance cut-off point. Pearson's correlations were used to explore possible relations between mean appreciation and implementation scores. In view of the small number of teachers in the study, we used a significance cut-off point of 0.10.

Qualitative data from the classroom observations were coded (in terms of programme adherence). Data from the telephone interviews were analysed by recording the interviews, preparing transcripts and coding these (in terms of programme adherence) with the NVIVO 8.0 qualitative data documentation and analysis software (QSR International, Doncaster, Australia). All codes were checked by a second researcher. Final summaries were written based on consensus about the codes between the two researchers.

Results

Response and participant characteristics

In the 13 schools that participated, 89 of the 1117 students did not complete the student evaluation form. The reason for this non-response as reported by the teachers was that these student had been absent from the lesson in which the evaluation form was completed. The final sample consisted of 1028 students. Around half of the students were male (51.2%). Most students were of Dutch origin (79.2%), attended the second year (64.7%), and were in the higher educational subtracks (77.3%). The students' SEP was comparable to the national mean (Table 2.2).

Table 2.2 Participant characteristics (n=1028)

	Mean (SD) or %
Gender (%)	
Boys	51.2
Girls	48.8
Year (%)	
First	35.3
Second	64.7
Educational track (%)	
Lower subtrack of prevocational education	22.7
Higher subtracks of prevocational education	77.3
Ethnic status (%)	
Both parents born in het Netherlands	79.2
One or both parents born abroad	20.8
Mean age in years (SD)	13.0 (0.8)
Socio-economic position score based on postal code area (scale 4 to -4, low to high)	-0.04 (0.86)

The majority of the 22 teachers who implemented the lessons were female (n=13). The subjects they taught were biology (focused on technical knowledge, e.g. on nutrients) (n=5), care (focused on practical knowledge and skills, e.g. cooking skills) (n=8) or both subjects (n=9). Their average teaching experience was 11 years (SD=9 years). Seven schools had only one teacher teaching the Krachtvoer lessons, while the six other schools used two to five. The teacher logbook was fully completed by 18 teachers (81.8%). All non-respondents (two males, two females) worked at the same school, from which only one teacher logbook was received. The reason for this non-response was considered to be communication problems at the school. The five randomly selected teachers who were approached for classroom observations were all willing to participate, as were the six teachers who were approached for telephone interviews.

Student and teacher appreciation

On average, the students rated the programme as 7.3 (SD=1.3) out of 10. Table 2.3 shows that the teachers' total mean appreciation scores for the fixed lessons, the optional activities and the supportive materials were 7.0, 7.5 and 7.4, respectively. The most appreciated lessons and optional activities by students and teachers were food tasting and preparation activities. Teachers as well as students gave the lowest score to the evaluation of the personal plans. The supportive materials most appreciated by teachers and students were the lunchbox and take-home bag. The largest difference between student and teacher appreciation was found for the website, which was rated as 6.7 by the

students and 7.7 by the teachers. Appreciation of the lessons that had undergone major changes (lessons 6, 7, and 8) and the added pre-programme optional lesson was comparable to that of the other lessons (average scores between 6.9 and 7.6 for teachers and between 6.5 and 7.2 for students).

The subgroup analyses revealed that the overall appreciation of the programme was higher among girls, first-year students, students in the lower educational subtrack, students with lower SEP, students of non-Dutch origin and students with more favourable fruit and snack intakes (Table 2.4). As regards the specific programme elements, higher appreciation rates for the majority of elements were found among girls, first-year students and students with more favourable dietary intakes.

Completeness of programme implementation

Lessons 1, 2, and 3 were implemented by all teachers, while the final lesson (evaluation of personal plan) was implemented by the smallest number of teachers (n=11) (Table 2.3). The most frequently implemented optional activities were the taste testing, the pre-programme activity on nutrients and the magazine activity. Few teachers implemented the fruit shake preparation activity (n=5) or the fruit tasting activity (n=4), which were alternatives to the taste testing activity. Of the five supportive materials, the website was the only one not used by all teachers (two did not use it). On average, teachers implemented 6.1 (SD=1.1) of the 7 fixed lessons (or components thereof) (range 4-7) and 4.6 (SD=1.38) of the 7 optional activities (range 2-7).

Table 2.3 Student and teacher programme appreciation and completeness of implementation of the programme elements

Lesson	Mean score student programme appreciation (SD) ¹ ; valid n	Mean score teacher programme appreciation (SD); valid n	Mean score teachers' completeness of implementation of programme elements (SD) ² ; valid n (%)
Fixed lessons (or parts thereof)			
1 Nutrition, foods and health	–	7.0 (1.3); n=18	–
2 Fruit and fruit juices	–	7.0 (0.9); n=18	0.78 (0.21); n=18 (100%)
3 Breakfast and snacks	–	7.2 (1.0); n=18	0.64 (0.25); n=18 (100%)
4 Part 1: Barriers to healthy eating	–	7.0 (1.0); n=15	0.75 (0.27); n=15 (83%)
6 Advertisements	7.2 (1.8); n=385	7.5 (1.3); n=13	0.56 (0.25); n=15 (83%)
7 Part 2: Personal action plans	6.9 (1.9); n=348	7.6 (1.5); n=12	0.47 (0.30); n=15 (83%)
8 Evaluation of personal plans	6.5 (1.7); n=361	6.9 (1.5); n=10	–
Total		7.0 (0.7)	0.70 (0.17)
Optional activities			
0 Nutrients	–	7.0 (0.7); n=15	0.77 (0.20); n=15 (83%)
5 Taste testing	8.2 (1.5); n=765	8.1 (0.8); n=17	0.88 (0.22); n=17 (94%)
5 Fruit tasting	–	8.1 (1.1); n=4	–
5 Preparing a fruit shake	8.0 (1.6); n=421	8.2 (1.2); n=5	0.90 (0.22); n=5 (28%)
4-7 National recipe contest	7.2 (1.6); n=699	7.2 (1.5); n=16	–
4-7 Magazine	6.7 (1.6); n=700	7.4 (1.2); n=17	0.61 (0.26); n=14 (78%)
4-7 Tests on website	6.9 (1.5); n=679	7.4 (1.3); n=16	–
Total		7.5 (0.7)	0.83 (0.09)
Supportive materials			
Lunchbox	7.6 (1.4); n=799	8.0 (1.7); n=18	–
Take-home bag	7.4 (1.6); n=671	7.6 (1.6); n=18	–
Postcards	6.7 (1.5); n=612	7.0 (1.3); n=18	–
Posters	6.8 (1.5); n=587	6.7 (1.2); n=18	–
Website	6.7 (1.7); n=618	7.7 (1.2); n=16	–
Total		7.4 (1.1)	–

¹ A scale from 1-10 was used for appreciation scores. A higher score indicated higher appreciation. No appreciation data were available on the items indicated as –

² Some of the lessons and optional activities consisted of one activity, so no lesson or optional activity completeness scores were available for elements indicated as –

Table 2.4 Students' characteristics related to overall programme appreciation and programme element appreciation

	Gender (girls=0, boys=1)	Year (first=0, second=1)	Educational track (low=0, high=1)	SEP (4 to -4, low to high)	Ethnicity (Non- Dutch=0, Dutch=1)	Fruit intake	Breakfast frequency	Snack frequency
Overall programme appreciation	-0.08*	-0.09*	-0.24***	0.09*	-0.09**	0.07*	-	-0.07*
Lessons								
Advertisements	-0.17***	-0.12**	-	-	-	-	0.12**	-
Action plan computer program	-0.19***	-0.16***	-	-	-	0.10*	-	-0.09*
Optional activities								
Taste testing	-	-	0.09**	-	-	-	-	-
Preparing a fruit shake	-	-	-	-	-	-	-	-
Recipe contest	-0.16***	-0.23***	-	-	-	-	-	-0.78*
Tests on website	-	-0.11**	-	-	-	-	-	-0.08*
Magazine	-0.11**	-0.12**	-	-	-	-	-	-0.10**
Supportive materials								
Lunchbox	-	-0.18***	-	-	-	-	0.09*	-
Take-home bag	-	-0.09*	-	0.09*	-	-	-	-
Postcards	-0.85*	-0.11**	-	-	-	-	-	-
Posters	-0.14**	-0.18***	-	-	-	-	-	-
Website	-0.13***	-0.13***	-	-	-	-	-	-

***P<0.001, **P<0.01, *P<0.05

The total mean completeness of implementation scores for the fixed lessons and the optional activities were 0.70 and 0.83, respectively. The lowest mean score was found for the action plan computer program (mean=0.47). The fruit shake preparation activity was most completely implemented (mean=0.90).

Reasons for skipping certain learning activities were mostly time-related, due to competing other events/activities (such as project weeks, national holidays) (n=11), especially for the final lessons. Some teachers had postponed lessons until a later moment in the same school year (n=4). Practical issues were also mentioned, such as lack of cooking or computer facilities (n=4) and food items being past their use-by date due to delayed programme implementation (n=1). All other reasons were mentioned by only one or two teachers; they included loss of students' enthusiasm about the programme, and activities being considered irrelevant (e.g. students were already aware of their own dietary intakes).

Programme adherence

The teacher logbooks revealed that the intended order of the eight lessons was followed by all but one teacher, who postponed one lesson to the end of the programme. On average, teachers spent 8.4 weeks teaching the programme (range 1.5 to 16.0 weeks). Ten of the 18 teachers had implemented the programme over the intended implementation period. Time allocated for the lessons was considered sufficient by the majority of teachers. Some deviations from the intended programme were found, such as letting students work on the programme individually (as homework) instead of in groups, using too many additional materials, technical problems with the action plan computer program, and altering the fruit shake recipe by adding sugar. Some teachers were faced with problems keeping order in class.

Relations between completeness of programme implementation and student and teacher appreciation

Teacher appreciation of the lessons was significantly positively correlated with teacher appreciation of the optional activities and the number of optional activities implemented (Table 2.5). Teacher appreciation of the supportive materials was significantly positively correlated with the number of lessons and optional activities implemented. A significant negative relation was found between the number of optional activities implemented and the completeness of lesson implementation.

Table 2.5 Correlations between total scores for programme appreciation and completeness of implementation (n=18)

	Appreciation			Implementation			
	Teachers' lesson appreciation	Teachers' optional activity appreciation	Teachers' supportive material appreciation	Number of lessons implemented	Number of optional activities implemented	Lesson completeness	Optional activity completeness
Appreciation							
Students' overall programme appreciation	-0.26	-0.19	0.09	0.33	0.30	-0.04	-0.23
Teachers' lesson appreciation	1	0.80***	0.37	0.16	0.45*	0.36	-0.01
Teachers' optional activity appreciation		1	0.13	0.29	0.26	0.10	-0.09
Teachers' supportive material appreciation			1	0.55**	0.51**	0.04	-0.02
Completeness of implementation							
Number of lessons implemented				1	0.23	0.01	-0.18
Number of optional activities implemented					1	-0.40*	-0.18
Completeness of lessons						1	-0.11

***P<0.001, **<0.05, *P<0.10

Discussion

The aim of the present study was to investigate the appreciation of the Dutch Krachtvoer healthy diet promotion programme among teachers and students, as well as the completeness of implementation and adherence to the programme, and the relation between programme appreciation and the level of completeness of implementation.

Programme appreciation among students and teachers was satisfactory. Compared to the findings of the process evaluation of the first version of the programme (Martens, et al., 2006), appreciation of those programme elements that had undergone major revisions was now comparable to that of the unchanged elements, indicating an increase in the intrinsic programme quality. Programme elements which included the preparation, tasting, or distribution of foods were appreciated most, as has also been reported by others (Warren, Henry, Lightowler, Bradshaw, & Perwaiz, 2003; Wind, et al., 2008). The inclusion of such activities is recommended because of high appreciation rates and the potential contribution to behavioural change.

Our results on appreciation scores in subgroups of students show that the programme revisions were successful in making the programme appeal to a wider target group, including students of non-Dutch ethnicity, students attending a lower educational subtrack and students with more favourable dietary intakes. Girls were more positive about more than half of programme elements than boys, though this had not been intended by the developers. Although a recent comparable study (Wind, et al., 2008) found no gender differences in the appreciation of a healthy diet programme, previous studies found greater involvement in nutrition issues and more nutrition knowledge among girls and young women (Hart, Bishop, & Truby, 2002; Wang, Ou, Chen, & Duan, 2009), which may explain the higher appreciation of our programme among girls. Our finding that first-year students appreciated almost all programme elements better than second-year students indicates how important it is that programmes for youngsters are made age-specific, although appreciation among second-year students was still acceptable. Developing different programme materials for specific age groups may lead to higher costs. Students with more favourable dietary intakes appreciated half of the programme elements better than the other students. It is plausible that those who regard health as important are more inclined to appreciate health promotion initiatives and also show more healthy nutrition behaviour.

The number of programme elements implemented can be regarded as satisfactory, with 6 of the 7 fixed lessons (87%) and almost 5 of the 7 optional activities (65%) implemented. Although different measures were used in

previous studies, which complicates comparisons, the implementation rates found in the present study match those of other school-based programmes, which ranged from 48% to 93% (Buckley & Sheehan, 2009; Reinaerts, Crutzen, Candel, de Vries, & de Nooijer, 2008; Reubsaet, Reinaerts, Brug, van Hooff, & van den Borne, 2004; Wiecha, et al., 2004; Wind, et al., 2008; Young, et al., 2008). The only study which reported comparable measures of completeness of lesson implementation (in terms of activities per lesson) showed a slightly higher rate of 90% (similar to a score of 0.90 for our measure) (Reynolds, et al., 2000), compared to our average rate of 0.70 for fixed lessons and 0.83 for optional activities.

In line with the findings of the evaluation of the first programme version, the present results show that the final two lessons had the lowest scores for appreciation and completeness of implementation. This may have been caused by aspects relating to the lessons as such, such as technical problems with the action plan computer program and the need to book a computer room for lesson 7, and the reflective nature of lesson 8. Logistical issues and class scheduling have been reported as barriers in other studies as well (Buston, et al., 2002; Reynolds, et al., 2000), and reflective lessons require more complex teacher skills. The low scores could also be due to the fact that the lessons were implemented at the end of the programme. Lower implementation rates of the final lessons have also been reported by others (Buston, et al., 2002; Martens, et al., 2006; Reinaerts, et al., 2008; Reubsaet, et al., 2004; Young, et al., 2008). This may be inherent to implementation, possibly because students and/or teachers grow tired of a topic after spending much time on it, or because of time pressure, since other topics need to be taught as well. Time constraint was also reported as a barrier in other studies (Buston, et al., 2002; Reubsaet, et al., 2004; Reynolds, et al., 2000; Singh, Chin, Brug, & van Mechelen, 2009). Lower implementation rates towards the end of a programme should therefore be taken into account by programme developers.

With regard to adherence, no problems were reported with the order of the lessons, which is an improvement compared to the evaluation of the first version (Martens, et al., 2006). Almost half of the teachers did not implement the lessons within the intended time period. No corresponding data are available from the first trial. The finding could be explained by the fact that the lessons were taught in a busy period of the year, which may be less of a problem if teachers can decide for themselves when to implement the lessons. The classroom observations and telephone interviews revealed some other specific deviations from the teacher manual. The data collected in this study do not allow us to assess how frequent these deviations were, what caused them and how they impacted on the programme's results. However, it is obvious that

the dissemination strategy should include specific strategies to deal with these adherence issues.

The final goal of our study was to explore the relation between programme appreciation and completeness of implementation. Three moderately positive correlations between teacher appreciation and the number of lessons and optional activities implemented indicate that programme appreciation by the teachers might be an important determinant of implementation. This supports the idea that health promotion programmes should be developed and continually revised in close collaboration with teachers in order to meet the needs of students and teachers and to ensure that the programme fits changing socio-political contexts (e.g. national dietary guidelines or changes in the educational system). The moderately negative relation between the number of optional activities implemented and the completeness of lesson implementation (in terms of activities per lesson) indicates that some teachers may have favoured quantity over quality. This issue needs to be dealt with in the dissemination strategy.

Some strengths and limitations of our study remain to be addressed. Programme appreciation by students and teachers has not often been examined this thoroughly in process evaluation studies, but proved to offer added value. It indicates that students from the expanded target group also appreciated the programme well and provides information about programme elements that are most eligible for improvement, either in general or for specific subgroups. Few studies have measured completeness of implementation of specific programme elements, which is a strength of our study, making it more specific. Our findings can help others develop methods and strategies suitable for specific subgroups. We used more extensive appreciation measures for teachers than for students, since extensive measures were considered infeasible for students. This complicates comparisons of appreciation rates between students and teachers. A limitation with respect to completeness of implementation measures is that some teachers implemented the lessons in multiple (up to eight) classes, but teacher logbooks were only filled in once by each teacher. Variations between classes taught by one teacher were therefore not accounted for. Still, the logbooks probably did not influence students' reactions the way observations by researchers might do.

Our study has some implications for further research. Although we think that this study represents a step forward regarding the assessment of programme appreciation and completeness of implementation, further improvement of and agreement on measures is necessary. A complicating factor is that process evaluation measures need to be tailored to specific interventions. A promising but time-consuming method for measuring implementation

quality is the use of video-recorded observations, which was applied in a study by Johnson and colleagues (Johnson, et al., 2010). Further quantitative research is needed to investigate relations between appreciation by target group members and programme implementers, completeness of programme implementation and programme adherence.

Conclusions

Our findings show that the revisions introduced in the Krachtvoer programme have resulted in a programme that was well appreciated, also by the expanded target group. It was implemented to a high degree of completeness. Nevertheless, this second process evaluation study again revealed several points that could be further improved, showing the importance of continued programme updates and repeated evaluation.

Chapter 3

Healthier food choices as a result of the revised healthy diet programme Krachtvoer for students of prevocational schools: the results of a clustered randomized controlled trial

Bessems, KMHH, van Assema, P, Martens, MK, Paulussen, TWGM, Raaijmakers, LGM, de Rooij, M & de Vries, NK.

Awaiting final decision on submitted manuscript

Abstract

Krachtvoer is a Dutch healthy diet programme for prevocational schools, developed in 2001 and revised for a broader target group in 2007, based on the findings of an evaluation of the first version. The goal of this study was to report on the short- and longer-term total and subgroup effects of the revised programme on students' fruit, fruit juice, breakfast, and snack consumption. Schools were randomized to the experimental condition, teaching the Krachtvoer programme, or in the control condition teaching the regular nutrition lessons. Self-reported consumption of fruit, fruit juice, breakfast and snacks was measured at baseline directly before programme implementation, one to four weeks after finishing programme implementation, and after six months. Mixed linear and logistic regression analyses were conducted. In total 1117 students of 13 experimental schools and 758 students of 11 control schools participated in the study. Short- and longer-term favourable intervention effects were found on fruit consumption. For fruit juice consumption only short-term favourable effects were revealed. Intervention effects on breakfast intakes were limited. No changes in snack frequency were reported, but students made healthier snack choices as a result of the programme. Some favourable as well as unfavourable effects occurred in subgroups of students. The effects on fruit consumption and snack choices justify the current nationwide dissemination of the programme. Achieving changes in breakfast consumption may, however, require other strategies.

Introduction

Unhealthy diets, such as low consumption of fruit and breakfast and high consumption of high-fat snacks, are common among youngsters in the Western world (Larson, Neumark-Sztainer, Hannan, & Story, 2007; World Health Organization, 2008) including the Netherlands (Martens, et al., 2008; Raaijmakers, et al., 2009; RIVM, 2004). Improvement of dietary intakes can prevent overweight and obesity and the prevalence of chronic diseases later in life (World Health Organization, 2005). Schools are considered an obvious setting for health promotion initiatives since the target population can easily be reached there. Reviews have shown moderate evidence that such school-delivered healthy diet programmes have effects on dietary intakes, such as fruit and vegetable intake and fat intake of children and adolescents (Ammerman, Lindquist, Lohr, & Hersey, 2002; Knai, Pomerleau, Lock, & McKee, 2006; van Cauwenberghe, et al., 2010).

Krachtvoer is a Dutch school-based healthy diet programme for 12- to 14-year-olds attending the first two years of prevocational education. The programme specifically targets prevocational schools, since these often incorporate a relatively large proportion of students from families with lower socio-economic positions (SEP) (Sociaal Cultureel Planbureau, 2003). Students coming from families with lower SEP tend to have less healthy dietary habits than their peers from more privileged families (Hanson & Chen, 2007; Sherwood, Wall, Neumark-Sztainer, & Story, 2009).

The Krachtvoer programme aims at increasing the consumption of fruit, achieving a daily healthy breakfast, and decreasing the consumption of fats by replacing high-fat snacks (e.g. chocolate, potato chips) by non-fat or low-fat snacks (Bessems, et al., 2011).

The programme consists of eight lessons and builds on the three main phases in Self-Management Theory (Boekaerts, et al., 2000) successively aimed at raising awareness on personal dietary intakes, proposing solutions for not meeting Dutch dietary recommendations, and setting personal goals for dietary improvement (Martens, et al., 2006). The programme also incorporates insights from the literature on awareness (Oenema, 2004), the Theory of Planned Behaviour (Ajzen, 1991), the Attitude-Social influence-Self Efficacy Model (de Vries, et al., 1988) and the action planning literature (Sniehotta, 2009). A programme overview is presented in Figure 1.1 (page 19).

The Krachtvoer programme was first developed and evaluated in 2001 and revised in 2007. A clustered randomized controlled trial of the first version of the programme showed mixed effects on students' dietary intakes immediately after programme implementation (Martens, et al., 2008). Some effects were

revealed in the whole group of students, others were only revealed in student subgroups. The programme was effective in increasing fruit consumption in the whole group. As regards breakfast, no effects were found on breakfast frequency, but some beneficial effects were found in subgroups of students in terms of nutrients consumed at breakfast. Mixed results were found for high-fat snack consumption in subgroups of students. Although the process evaluation of the first version of the programme yielded positive results in terms of programme appreciation and implementation, programme improvements were still recommended (Martens, et al., 2006). Nationwide dissemination required expanding the target group to include students from a lower educational subtrack within prevocational education and students of non-Dutch ethnicity. For the students with more favourable baseline dietary intakes, who were already part of the target group, additional methods were needed to prevent opposite programme effects.

The development of health promotion programmes often ends after the first programme evaluation, although longer-term effects may not yet have been evaluated, and process findings may not have been incorporated in a revised version of the programme. We were unable to find any repeated evaluation studies with the aim to sequentially improve programme outcomes after initial field testing.

This current paper describes the evaluation of the revised version of the Krachtvoer programme. The first aim of this paper was to determine if the revised Krachtvoer programme had short- and longer-term effects on students' consumption of fruit, fruit juice, breakfast, and high-fat snacks. The second aim was to explore whether the effects varied in subgroups of students by gender, educational track, year of the class (first or second), and baseline dietary intakes.

Methods

Study design, sample, and data collection

Between February and June 2008 health promotion professionals from five Dutch Regional Public Health Services (RPSSs) spread over the Netherlands were asked to recruit a total of 25 schools out of 110 schools that offered lower vocational education to at least 50 first- or second-year students, and that did not participate in another study of the RPHS. Recruitment took place in accordance with the steps of the adoption strategy (Bessem's, et al., 2011). Adopting schools were randomly assigned to the experimental or the waiting-list control condition by an independent researcher using a computerized random number generator. Teachers from experimental schools were asked to

implement the Krachtvoer lessons over a period of eight weeks between September to December 2008, while control schools carried out the usual nutrition education curriculum aimed at increasing knowledge in the same period and postponed Krachtvoer implementation for one year. Teachers implemented the lessons in the first- and/or second-year classes in which the topic nutrition was scheduled for the school year 2008-2009. Students completed questionnaires individually as a classroom activity at baseline (1-4 weeks before implementation), at posttest (1-4 weeks after implementation), and at the repeated posttest (6 months after implementation). The teachers supervised the completion of the questionnaires. In case of objection students could fulfil another task during the lesson. The study was exempt from ethical review according to Dutch standards.

Measures

Background variables included gender, country of birth of both parents, and postal code. Students' ethnicity was defined as non-native if at least one of the parents had been born abroad (Keij, 2000). Postal code was used as an indicator of SEP, based on a factor score (range -4 to 4 [high to low]) calculated over four indicators of the SEP of people living in Dutch postal code areas (Centraal Bureau voor de Statistiek, 2009; Sociaal Cultureel Planbureau, 2006). Teachers provided data on school-related variables including educational track (lower [subtrack 2 of prevocational education] or higher [subtracks 3 and 4 of prevocational education] and year of the class (first of second).

One item on the number of days a week on which fruit (or fruit juice) was usually consumed, and one item on the number of servings of fruit or glasses of fruit juice consumed on these days were taken from a validated fruit and vegetable food frequency questionnaire (FFQ) (van Assema, et al., 2002). Frequency and quantity scores were multiplied and divided by 7 to obtain the average fruit and fruit juice consumption per day.

Breakfast consumption was measured with one FFQ item on the number of days a week on which breakfast was usually consumed. A recall item for that morning's breakfast was used to assess if students had consumed breakfast that morning and as an indicator of breakfast quality in terms of nutrient intake. Breakfast was defined as foods and drinks consumed within two hours after getting up.

A snack consumption FFQ item was derived from a validated fat consumption questionnaire (van Assema, et al., 2001) and asked for the number of days a week on which students usually consumed snacks (except fruit and vegetables) and the number of times snacks were consumed on these days. These two numbers were multiplied and divided by seven to obtain the average

number of times a day that snacks were consumed. Five items were used to measure the usual consumption of snacks from five snack groups: sweets (e.g. chocolate, acid drops), savoury snacks (e.g. potato chips, popcorn), ice-creams (e.g. soft ice-cream, water ice), fried snacks (e.g. minced-meat hot dog, Vietnamese spring roll), and cookies (e.g. chocolate cookies, fibre cookies). In line with the national recommendations, (Voedingscentrum, 2006) favourable products and unfavourable products were distinguished within each snack group (e.g. water ice versus soft ice-cream). Frequency items were formulated for each snack group (e.g. which category of ice-creams do you usually consume?: “I do not eat ice-cream”, “I usually eat [followed by examples of favourable products, such as water ice],” “I usually eat [followed by examples of unfavourable products such as soft ice-cream],” and “I consume ice-creams from both categories equally”).

Statistical analyses

Since fruit and fruit juice frequency variables were not normally distributed, the data were log-transformed. The breakfast frequency variable was extremely skewed and therefore dichotomized based on the dietary recommendations (daily consumption [coded as 1] versus less than seven days [coded as 0]). Two types of analysis were performed on the open-ended recall item of that mornings’ breakfast consumption. First, we coded whether students had eaten breakfast (yes/no). Second, total energy intake and nutrients (total fat, saturated fat, carbohydrates, proteins, and fibres) were calculated using the nutrients calculation Eetmeter programme (Voedingscentrum, Den Haag, Netherlands), and log-transformed.

The snack frequency variables were log-transformed. The responses to the five questions on the *usual consumption of sweets, cookies, savoury snacks, ice-cream, and fried snacks* were dichotomized (“favourable”: no consumption and more frequent consumption of favourable products [coded as 1] and “unfavourable”: more frequent consumption of unfavourable products or equally frequent consumption of favourable and unfavourable products [coded as 0]).

Mixed linear regression analyses were conducted, in which the programme accounted for missing data based on the observed data. This method also corrects for nested designs by including random intercepts. Mixed linear and mixed logistic regression were conducted using PASW Statistics 17 (SPSS Inc. Chicago, IL) for continuous outcomes and MLwiN version 2.02 (Centre for Multilevel Modelling, Bristol, UK) for binary outcomes.

Baseline differences between the intervention and control conditions were assessed with mixed logistic regressions with condition as the outcome variable (control = 0, experimental = 1), and with student background variables (gender,

educational track, year, ethnicity and SEP) and baseline dietary intake variables (fruit, fruit juice, snack, breakfast) as fixed factors, and with a random intercept of class. Selective dropout was tested using comparable analyses with dropout at the posttests as outcome variables. An 0.05 significance level was used for these analyses.

The short- and longer-term intervention effects were analyzed using mixed linear and mixed logistic regression. The dependent variables were the primary outcomes on fruit, fruit juice, breakfast, and snack intakes. Short- and longer-term intervention effects on these outcomes were examined by including interactions between posttest and condition, and by including the separate fixed factors of gender, educational track, year, baseline dietary intake, ethnicity and SEP. P-values below 0.05 were considered significant. Subgroup analyses were done for both posttests in case of significant moderators of posttest, condition and one of the individual predictors of gender, educational track, year, and dietary intakes at baseline (low intakes at baseline coded as 0, high intakes as 1).

Results

Response rates, baseline differences and missing values

A total of 25 schools with 2097 students participated in the study. Twenty-two of the 25 schools were randomly assigned to the control condition (N=8) or the experimental condition (N=14). Three others were assigned to the control condition at their own request, since one school had already ordered other teaching materials, a second school was already participating in an alcohol prevention programme, and the last school had to invest in activities to stop the decline in student numbers. One experimental school with 222 students was excluded, since it had not implemented the Krachtvoer programme due to logistical problems at the school. The number of experimental schools was higher than that in the control condition, to increase the power of an accompanying implementation study (Bessems, van Assema, de Vries and Paulussen, submitted).

The final sample for analysis consisted of 13 experimental schools with 53 classes and 1117 students, and 11 control schools with 38 classes and 758 students. Compared to the control condition, the experimental condition included more second-year students (OR=2.62; $p<0.05$) and more students attending the higher educational subtracks (OR=3.60; $p<0.001$). Dropout numbers at the first posttest were 89 for the experimental condition and 77 for the control condition, and those at the second posttest 101 and 76, respectively. Reasons for drop-out were absence from the lesson in which the questionnaire

was completed and incomplete background characteristics which made it impossible to link the separate measurements. Drop-out was not selective.

The final population had a mean age of 12.9 years. Most students attended the higher educational subtracks (65.9%) and were in second year (58.9%). Students were representative of the Dutch prevocational student population with just over half of participants being female, 80% being of Dutch ethnicity, and a mean SEP comparable to the average Dutch score of 0 (Table 3.1).

Most missing values were related to the snack category items (20% missing values for sweets, savoury snacks, biscuits, ice-creams, and 21% missing values for fried snacks). None of the other outcome items had more than 15% missing values.

Table 3.1 Baseline scores for background characteristics and differences between control (n=758) and experimental condition (n=1117)

	Uncorrected % Total group	Uncorrected % Control condition	Uncorrected % Experimental condition	Odds ratio (CI) baseline difference
Gender				1.024
Boys	52.3%	42.2%	51.4%	(0.831-1.263)
Girls	47.7%	57.8%	48.6%	
Ethnicity				0.987
Dutch	80.4%	81.8%	79.4%	(0.756-1.289)
Other	19.6%	18.2%	20.6%	
Year				2.617*
First year	41.1%	50.9%	34.4%	(1.050-6.523)
Second year	58.9%	49.1%	65.6%	
Educational track				3.597**
Theoretical subtracks of prevocational education and senior general education (higher subtracks)	65.9%	50.5%	76.3%	(1.412-9.161)
Practical subtrack of prevocational education (lower subtrackl)	34.1%	49.5%	23.7%	
	Total group Uncorrected Mean (SD)	Control condition Uncorrected Mean (SD)	Experimental condition Uncorrected Mean (SD)	t-test (CI) baseline difference
Socio-economic position mean factor score (SD) (range 4 to -4; low to high)	-0.03 (0.88)	-0.01 (0.91)	-0.04 (0.86)	1 (0.874-1.145)

To test baseline differences, we corrected for a random intercept for class

*p<.05; **p<.01 ***p<.001

Effects on fruit, breakfast, and snack consumption

Table 3.2a shows the short- and longer-term effect estimates for the continuous outcome measures of fruit, fruit juice, nutrients consumed at breakfast, and snack consumption. Table 3.2b shows the short- and longer-term effect estimates for the dichotomous outcome measures of breakfast frequency and snack consumption. Table 3.3 presents significant intervention effects in subgroups.

Short- and longer-term favourable intervention effects were found for fruit frequency and yesterday's fruit consumption. A significant short-term increase in fruit juice consumption was found in the experimental group (Table 3.2a), attributable to an effect among students with a higher baseline frequency (Table 3.3).

No intervention effects were found for the breakfast frequency item or the percentage of students who had consumed breakfast that morning (Table 3.2b). A favourable short- and longer-term intervention effect on fibres was seen for students who had eaten breakfast (Table 3.2a). The short-term effect was attributable to a favourable effect among the subgroup of first-year students, while the longer-term effect was attributable to a favourable effect among students with the lowest fibre intakes at baseline (Table 3.3). A short-term effect on carbohydrates was seen among students attending the higher educational subtracks (Table 3.3), and a longer-term effect among the whole group (Table 3.2a). Energy intake at breakfast increased significantly among first-year students, in both the short and longer term, and in the short term among students attending the higher educational subtracks. A significant increase in fat and saturated fat intake was seen among first-year students (Table 3.3).

The outcome variables regarding snack frequency and yesterday's snack consumption did not show any effects (Table 3.2a). Some favourable effects were revealed regarding the categories of snacks consumed (Table 3.2b), including short- and longer-term effects on sweets consumption and short-term effects on the consumption of savoury snacks, ice-creams, and fried snacks. Students who had eaten items from the unhealthy ice-cream category at baseline showed a beneficial effect in the short term, while the opposite was found for students who had consumed products from the healthier ice-cream category at baseline (Table 3.3). The intervention had an adverse short-term effect on ice-cream consumption among students from the lower educational subtrack (Table 3.3). Cookies consumption did not change significantly as a result of the intervention (Table 3.2b).

Table 3.2a Results of the mixed linear analyses of continuous outcomes of fruit, snacks, and breakfast consumption

	Experimental condition				Control condition		B short-term effect		B longer-term effect	
	T0 (n=1117)	T1 (n=1028)	T2 (n=1016)	T0 (n=758)	T1 (n=681)	T2 (n=682)				
Fruit										
Fruit frequency (servings a day)	0.98 (0.80)	1.13 (0.81)	1.03 (0.81)	1.11 (0.86)	1.11 (0.92)	1.01 (0.85)	0.048***	0.033***		
Yesterday's fruit consumption (servings)	0.97 (0.90)	1.23 (0.94)	1.18 (0.98)	1.02 (0.86)	1.16 (0.99)	1.08 (0.92)	(0.023-0.053)	(0.017-0.048)		
Fruit juice frequency (glasses a day)	1.00 (0.95)	1.09 (0.96)	1.06 (0.98)	1.02 (0.97)	0.98 (0.94)	1.01 (0.96)	0.023*	0.026*		
							(0.002-0.044)	(0.005-0.047)		
Snacks										
Snack consumption frequency (times a day)	1.90 (1.57)	1.86 (1.50)	1.84 (1.56)	1.86 (1.51)	1.90 (1.67)	1.87 (1.69)	0.022*	0.013		
Yesterday's snack consumption (number of snacks)	1.97 (1.51)	2.09 (1.59)	1.99 (1.60)	1.99 (1.54)	2.11 (1.74)	2.04 (1.74)	(0.004-0.041)	(-0.005-0.032)		
							0.001	-0.007		
							(-0.020-0.020)	(-0.026-0.013)		
							0.014	0.004		
							(-0.011-0.039)	(-0.021-0.030)		
Breakfast										
Energy (kcal) ¹	302.9 (163.9)	300.7 (146.2)	302.4 (144.4)	314.3 (169.0)	299.4 (158.3)	298.0 (154.7)	0.023	0.027		
Fat (grams) ¹	9.14 (7.44)	9.30 (7.08)	9.42 (6.96)	9.48 (8.01)	9.29 (7.33)	9.48 (7.70)	(-0.005-0.051)	(-0.001-0.056)		
							0.013	0.013		
Saturated fat (grams) ¹	4.35 (3.87)	4.47 (3.90)	4.55 (3.80)	4.61 (4.35)	4.60 (4.19)	4.80 (4.29)	(-0.030-0.055)	(-0.032-0.058)		
							0.005	0.006		
Carbohydrates (grams) ¹	40.93 (24.41)	40.14 (19.90)	40.26 (19.64)	42.10 (21.82)	40.02 (21.00)	39.06 (20.75)	(-0.039-0.046)	(-0.037-0.049)		
Protein (grams) ¹	11.72 (7.32)	11.41 (6.75)	11.50 (6.81)	12.06 (8.14)	11.51 (7.43)	11.68 (7.17)	0.025	0.039		
							(-0.005-0.054)	(0.008-0.069)*		
Fiber (grams) ¹	2.87 (2.53)	2.85 (2.45)	2.81 (2.05)	3.03 (2.11)	2.77 (2.03)	2.84 (2.26)	0.006	0.007		
							(-0.025-0.037)	(-0.025-0.039)		
							0.035	0.041		
							(0.005-0.064)*	(0.011-0.072)**		

Reported intervention effects were corrected for a random intercept of measurement, student, and class, and the fixed factors of gender, year, educational track, SEP, and ethnicity * P<0.05; **P<0.01; ***P<0.001. ¹ Breakfast nutrients were calculated for students who had consumed breakfast.

Table 3.2b Results of the mixed logistic regressions of dichotomous outcomes of snacks and breakfast consumption

	Experimental condition Uncorrected %			Control condition Uncorrected %			Odds Ratio for short-term effect (CI)	Odds Ratio for longer-term effect (CI)
	T0 (n=1117)	T1 (n=1028)	T2 (n=1016)	T0 (n=758)	T1 (n=681)	T2 (n=682)		
Breakfast consumption								
Breakfast frequency								
Daily	79.2%	73.7%	76.3%	77.2%	74.1%	75.3%	1.10 (0.79-1.54)	1.17 (0.83-1.64)
Less than seven days	20.8%	26.3%	23.7%	22.8%	25.9%	24.7%		
Consumed breakfast that morning								
Yes	88.0%	87.6%	84.7%	90.2%	85.8%	83.5%		
No	12.0%	12.4%	15.3%	9.8%	14.2%	16.5%	0.81 (0.53-1.26)	0.79 (0.52-1.20)
Snack consumption								
Sweets consumption								
Favourable category	39.1%	42.1%	44.6%	47.6%	41.4%	43.3%	1.36* (1.02-1.81)	1.48** (1.11-1.97)
Unfavourable category	60.9%	57.9%	55.4%	52.4%	58.6%	56.7%		
Savoury snacks consumption								
Favourable category	28.2%	30.9%	29.0%	34.8%	26.9%	31.8%	1.66** (1.22-2.26)	1.16 (0.85-1.57)
Unfavourable category	71.8%	69.1%	71.0%	65.2%	73.1%	68.2%		
Ice-cream consumption								
Favourable category	32.6%	38.5%	40.3%	37.9%	32.2%	37.7%	1.55** (1.15-2.09)	1.29 (0.97-1.74)
Unfavourable category	67.4%	61.5%	59.7%	62.1%	67.8%	62.3%		
Fried snack consumption								
Favourable category	64.9%	61.5%	61.8%	64.0%	62.1%	59.1%	1.58** (1.12-2.22)	1.29 (0.92-1.81)
Unfavourable category	35.1%	38.5%	38.2%	36.0%	37.9%	40.9%		
Cookies consumption								
Favourable category	64.9%	61.5%	61.8%	64.0%	62.1%	59.1%	0.90 (0.67-1.20)	1.01 (0.75-1.36)
Unfavourable category	35.1%	38.5%	38.2%	36.0%	37.9%	40.9%		

Reported intervention effects were corrected for a random intercept of measurement, student, and class, and the fixed factors of gender, year, educational track, SEP, and ethnicity * P<0.05; **P<0.01; ***P<0.001

Table 3.3 Intervention effects in subgroups on continuous outcomes regarding fruit, snack, and breakfast intakes, comparing the experimental group (n=1117) with the control group (n=758)

Intervention effects among first and second year				Intervention effects among students with more and less favourable baseline dietary intakes				Intervention effects among lower and higher educational subtracks				
	first-year	second-year	first-year	second-year	low baseline intakes	high baseline intakes	low baseline intakes	high baseline intakes	low baseline intakes	high baseline intakes	low educational subtrack	higher educational subtracks
Short-term effects B (CI)				Longer-term effects B (CI)		Short-term effects B (CI)		Longer-term effects B (CI)		Short-term effects B (CI)		
Fruit												
Fruit juice frequency (glasses a day)	-	-	-	-	-	0.034** (0.009-0.059)	-	-	-	-	-	-
Breakfast												
Total energy (kcal) ¹	0.056* (0.013-0.098)	-	0.053* (0.012-0.094)	-	-	-	-	-	-	-	-	0.044* (0.008-0.080)
Total fat (grams) ¹	-	-	0.072* (0.008-0.137)	-	-	-	-	-	-	-	-	-
Total saturated fat (grams) ¹	-	-	0.064* (0.003-0.126)	-	-	-	-	-	-	-	-	-
Total carbohydrates (grams) ¹	-	-	-	-	-	-	-	-	-	-	-	0.046* (0.007-0.086)
Total fiber (grams) ¹	0.085*** (0.041-0.129)	-	-	-	-	-	0.043* (0.006-0.081)	-	-	-	-	-
Short-term OR				Longer-term OR		Short-term OR		Longer-term OR		Short-term OR		
first-year	second-year	first-year	second-year	unfavourable baseline intakes	favourable baseline intakes	unfavourable baseline intakes	favourable baseline intakes	unfavourable baseline intakes	favourable baseline intakes	lower educational subtrack	higher educational subtracks	
Snacks												
Ice-cream	-	-	-	-	10.00*** (6.92-14.5)	0.12*** (0.08-0.18)	-	-	-	0.59* (0.38-0.91)	-	

Discussion

This paper reports on the effect evaluation of the revised Dutch healthy diet programme called Krachtvoer. Favourable effects of the intervention were found in the experimental group as a whole, though some mixed intervention effects emerged in subgroups.

The favourable intervention effects on fruit consumption were comparable to those found in the effect evaluation of the first version of the programme (Martens, et al., 2008), but the present study also enabled us to show some longer-term effects. Additionally, the present study found short-term effects on fruit juice consumption. Only two other secondary school programmes reported intervention effects on fruit consumption (Gratton, Povey, & Clark-Carter, 2007; Mihas, et al., 2010).

As in the first version, we found no effects on breakfast frequency and limited effects on fibre and carbohydrate intakes, which could be attributable to higher rates at baseline in the control condition. We found some additional intervention effects in subgroups regarding nutrients consumed at breakfast, but we also found some worrying effects, especially among first-year students. The limited effects on breakfast consumption may be attributable to numerous causes. First, there were large variations in the specificity of students' answers on the open-ended item about that morning's breakfast, which may have hampered the detection of changes at nutrient level. Second, students already had relative favourable baseline values for breakfast intakes. In fact, the percentage of Dutch youngsters who have breakfast each day is higher than that in other European countries (World Health Organization, 2008). Our results show that the mean energy intake at breakfast is around 300 kcal, which is in line with recommendations (Voedingscentrum, 2011). Third, as suggested by Kothe and colleagues (Kothe, Mullan, & Amaratunga, 2011), breakfast consumption may be more resistant to change than other nutrition behaviours. We found only one other healthy diet intervention study at secondary schools showing a small increase (0.5 to 0.7) in the number of days a week on which cereals were eaten at breakfast (Mihas, et al., 2010). Others found no programme effects on breakfast intakes of secondary school students (Kothe, et al., 2011; Neumark-Sztainer, Story, Hannan, & Rex, 2003). A study among Dutch students aged 10 to 18 showed that breakfast frequency decreases strongly from the age of 14 to 15 years onwards (Raaijmakers, et al., 2009). Therefore, our intervention might be more effective among an older age group.

In line with the effect evaluation of the first version (Martens, et al., 2008), we found no main intervention effects on snack frequency; subgroup effects from the first effect evaluation were not found this time. In agreement with the

purpose of the programme, significantly more students in the experimental condition reported consuming snacks from the favourable food categories (healthier choice or no snacks at all) at the first and/or second posttest. It is striking that the analyses for subgroups of students based on educational track and baseline dietary intakes revealed that students from the lower educational subtrack and students who consumed ice-creams from the more favourable categories at baseline had unfavourable short-term intervention effects, while students consuming from the unfavourable ice-cream category had beneficial short-term effects from the intervention. Others have reported mixed effects of health education in secondary schools, including beneficial changes in fat consumption during the day (Haerens, et al., 2006), reduced sugars and sweets during the day (Dunton, Lagloire, & Robertson, 2009), but also a lack of effect on snack intakes (Singh, et al., 2009). A Dutch study by Kocken and colleagues revealed that in-class education about snacks and soft drinks, accompanied by changes to the snack and soft drink vending machines, new product labels on snacks and soft drinks, and decreased price of low-calorie products led to higher sales of lower-calorie products in secondary schools (Kocken, 2008). Together with the findings of the current study, this indicates that healthier snack choices can be achieved by healthy diet interventions.

Design-related limitations of our study include the high non-response rates of up to 21% on our snack category items. Possibly the items were too difficult, so these items need further development and testing. Other limitations are the fact that our follow-up test took place only six months after programme implementation, and the fact that the use of self-reports by self-administered questionnaires may be problematic especially in studies aiming to identify effects on nutrients consumed at breakfast, as discussed above. Another limitation is that the number of students of non-Dutch ethnicity in our study population was too small to allow specific intervention effects in this subgroup to be examined, although we did adjust the programme by including information on culture-specific events (e.g. Ramadan), habits, and food products. Findings from the process evaluation study indicating high programme appreciation among this group are our best indication that our efforts were successful (Bessems, et al., submitted).

Programme-related limitations include implementation problems. Our process evaluation showed that programme implementation was good, except for the implementation of the final two lessons aimed at translating positive behavioural intentions into actions which were implemented by the fewest teachers (61%) (Bessems, et al., submitted). Additional dose response analyses may reveal whether this indeed caused the limited programme effects.

Strengths of our study include the study design, the high response rates, the statistical analyses performed, and the thorough assessment of effect moderators. The current study revealed some promising effects as a result of the improved programme in a wider population of lower-educated students, but further improvements are still possible. Programme revisions were successful and the repeated effect evaluation provided new information on the longer-term intervention effects and the effects among particular subgroups of students, while some effects in the total group changed as well. The dietary changes that we found are small, but even such small changes can contribute to changes in disease risk (Paineau, et al., 2010; RIVM, 2004) if implemented on a large scale.

Conclusion

It is important to continually update promising health promotion programmes such as Krachtvoer and to conduct repeated evaluation studies. Subgroup analyses can help us to detect unfavourable and favourable subgroup effects of interventions and provide recommendations for programme revisions. We conclude that Krachtvoer was not successful in changing breakfast habits, which was relatively good in our target group. The breakfast lessons should therefore be excluded from the next version of the programme. We were able to realize favourable changes in fruit and snack consumption in a relevant target group attending lower prevocational schools. Nationwide dissemination of the fruit and snack lessons is therefore recommended. To optimize effects on dietary behaviours, Krachtvoer should be incorporated as a component of a more comprehensive whole-school approach, targeting environmental influences as well (Contento, 2007; Hoelscher, et al., 2002; Laurence, et al., 2007).

Chapter 4

Examining the relationship between completeness of teachers' implementation of the Krachtvoer healthy diet programme and changes in students' dietary intakes

Bessems KMHH, van Assema P, Crutzen R, Paulussen TGWM & de Vries NK.

Submitted for publication

Abstract

The goal of this study was to examine if the completeness of programme implementation and the completeness of implementation of specific programme elements of the Dutch school-based healthy diet promotion programme Krachtvoer are related to short- and longer-term changes in students' fruit, snack and breakfast intakes. Data on students' dietary intakes were collected one to four weeks and six months after programme implementation. Teachers filled in a logbook on programme implementation after each lesson. The relations between changes in students' dietary intakes and completeness of implementation of the programme and of specific programme elements were tested using mixed linear regression analyses. A total of 13 Dutch prevocational schools with 876 students and 18 teachers participated in the study. Completeness of programme implementation was positively related to an increase in fruit consumption in the short term. Completeness of implementation of food exposure activities and a practical lesson on advertisements were related to an increase in fruit consumption in the short as well as the longer term. No such relations were found for snack and breakfast consumption. Our results indicate that efforts should be made to help teachers implement the programme as fully as possible.

Introduction

Reviews have found moderate evidence that theory-based healthy diet promotion programmes for children and adolescents in schools can change dietary intakes (Ammerman, et al., 2002; Knai, et al., 2006; van Cauwenberghe, et al., 2010). However, as soon as health promotion programmes are used in real-life settings, the most serious threat to their effectiveness is low levels of fidelity of programme implementation, also known as type 3 error (Dobson & Cook, 1980). Research in a range of settings has shown that various aspects of the implementation of health promotion interventions, such as adherence (implementation as intended by the developers) and completeness (the proportion of the activities proposed by the programme that was actually used), affect programme outcomes (Derzon, Sale, Springer, & Brounstein, 2005; Durlak & DuPre, 2008; Wilson & Kurz, 2008). Derzon and colleagues (2005) re-assessed the outcomes of 46 effectiveness studies of substance abuse prevention programmes, correcting for implementation and exposure of control groups, and found beneficial programme effects for 46% of the studies which initially reported no effects (Derzon, et al., 2005). Two other studies found that programme outcomes were not only related to overall implementation, but also to the implementation of specific programme elements (Stevens, van Oost, & de Bourdeaudhuij, 2001; Telzrow, McNamara, & Hollinger, 2000). Examining the relationship between the degree of completeness of programme implementation and the variability in programme outcomes can help us generate leads for programme improvement and the improvement of implementation strategies.

Krachtvoer is a Dutch school-based healthy diet programme for 12- to 14-year-olds attending the first two years of prevocational education. Programme goals are to increase the consumption of fruit, to decrease the consumption of fats by replacing high-fat snacks (e.g. fried snacks, sweets) by non-fat or low-fat snacks (Bessems, et al., 2011) and to stimulate daily consumption of a healthy breakfast. The programme consists of eight lessons, including fixed lessons (i.e. lessons with a fixed protocol) and optional activities. Some of the lessons are mainly theoretical, for example those with information on national dietary recommendations, while others are mainly practical, for example those including fruit shake preparation or tasting activities.

The programme was originally developed in 2001 and revised in 2007. A randomized controlled trial (RCT) of the revised programme revealed both immediate and longer-term (six months after the end of implementation) increases in students' fruit consumption. As regards snack intake, students consumed less often sweets from the unfavourable sweets category (e.g. less often chocolates, more often chewing gum or no sweets) (Bessems, van Assema,

Martens, Raaijmakers, de Rooij, Paulussen & de Vries, submitted). On the other hand, the trend towards falling breakfast frequencies which is seen among Dutch youngsters between the ages of 12 and 16 years (Raaijmakers, et al., 2009) did not slow down as a consequence of the programme.

The goal of the current study was to examine the relation between changes in students' dietary intakes and the level of completeness of programme implementation and of the implementation of specific programme elements. We used an outcome measure of fruit consumption and sweets consumption for which short- and longer-term effects had been found in the RCT (Bessems, et al., submitted). Although the RCT found no effects on breakfast frequency (i.e. breakfast frequency decreased in the experimental and in the control group), we included this measure to examine whether the lack of effect could be explained by a type 3 error. Specific research questions were:

1. Can the favourable changes in fruit and sweet consumption found in the RCT be related to the completeness of programme implementation, and to the completeness of implementation of specific programme elements?
2. Can the unfavourable changes in breakfast consumption found in the RCT be related to suboptimal programme implementation, and incomplete implementation of specific programme elements?

Content of the programme

The programme builds on the three phases of the self-management theory (Boekaerts, et al., 2000), successively aiming at raising awareness of personal dietary intakes, proposing solutions in order to meet the Dutch dietary guidelines, and setting personal goals for dietary improvement (Martens, et al., 2006). The main programme elements are three lessons intended to raise awareness, one practical food exposure activity (i.e. taste testing, fruit tasting or preparing a fruit shake), one lesson on the influence of advertisements, and two lessons in which students formulate, implement and evaluate a personal action plan. Optional activities are a pre-programme lesson on nutrients, knowledge tests on the programme website, and reading and discussing the *Krachtvoer* magazine. A programme overview is presented in Figure 1.1 (page 19).

Methods

Study design, sample and data collection

We included students from a RCT who were taught the *Krachtvoer* (Bessems, et al., submitted). Data were collected from 13 schools, 53 classes, and 1117

students. Student questionnaires were filled in as a classroom activity at baseline (T0; 1-4 weeks before the lessons), at posttest (T1; 1-4 weeks after the lessons), and at the follow up-test (T2; 6 months after the lessons). Students who objected against participation were allowed to do another task during the lesson. The study was exempt from ethical review according to Dutch standards. Completeness of implementation was assessed using teacher logbooks. All 22 teachers who implemented *Krachtvoer* were asked to complete the logbook after each lesson.

Measures

The student questionnaire assessed background variables, i.e. gender, country of birth of both parents as an indicator of ethnicity (non-Dutch if one or both parents had been born abroad (Keij, 2000) and postal code as an indicator of socio-economic position (SEP) (Sociaal Cultureel Planbureau, 2006). Teachers provided data on school-related variables, including the year of their class (first or second year) and the educational subtrack within the Dutch prevocational education system (lower [subtrack 2] or higher [subtracks 3 and 4]).

Fruit consumption items were derived from a validated fruit and vegetable food frequency questionnaire (FFQ) (van Assema, et al., 2002), and included an item on the number of days a week on which fruit was usually consumed, and an item on the number of servings of fruit consumed on these days. Frequency and quantity scores were multiplied and divided by seven to obtain the average fruit consumption per day. One item was used to measure the usual consumption of sweets. In line with the programme and the dietary guidelines provided by the Netherlands Nutrition Centre (Voedingscentrum, 2006) a distinction was made between unfavourable types of sweets (e.g. chocolates, candy bars) and more favourable types (e.g. acid drops, chewing gum). Frequency items were formulated (e.g. "which category of sweets do you usually eat?", with options "I do not eat sweets", "I usually eat [followed by examples of favourable products]," "I usually eat [followed by examples of unfavourable products]," and "I eat sweets from both categories equally"). Breakfast consumption was measured with one FFQ item about the number of days on which breakfast was usually consumed.

Completeness of implementation was measured by asking teachers to indicate which programme elements (lessons and optional activities) they had implemented. For each of the 14 programme elements, teachers could tick off the activities they had implemented on a list of all proposed activities. A score for completeness of element implementation (range 0-1) was calculated by dividing the number of implemented activities by the number of proposed activities within that programme element. A score for completeness of

programme implementation (range 0-14) was calculated as the sum of the scores for the activities of each programme element.

Statistical analyses

Student and teacher data were matched on demographics, class and school. Change scores for the continuous outcomes of fruit and breakfast intake were calculated by subtracting baseline scores from the scores at the two posttests. Descriptive statistics were used to describe the background characteristics of participating students and teachers, and the percentages of students who had changed their fruit, sweets and breakfast intakes at the two posttests. Mixed linear regression analyses were carried out using PASW Statistics 17 (SPSS Inc. Chicago, IL) for continuous outcomes and MLwiN version 2.02 (Centre for Multilevel Modelling, Bristol, UK) for binary outcomes. We tested for selective student drop-out (due to missing posttest data or implementation data) with mixed logistic regressions using MLWin, with drop-out at any moment as the outcome variable (inclusion=1, dropout=0), and with student background variables (gender, ethnicity, SEP, school year and educational subtrack) and baseline dietary intake variables (fruit, sweets, breakfast) as fixed factors, and with a random intercept of the class the student was in. Pearson's correlations were calculated to check if implementation scores for the 14 programme elements were strongly interrelated. Based on high Pearson's correlations (>0.75) and the content of programme elements, two sum scores were calculated, one for lessons 1 to 4 (creating awareness; range 0-4) and one for lessons 7 and 8 (personal plans; range 0-2). Since there was little variation between teachers implementing the three practical activities, we calculated one sum score for the taste testing, fruit tasting and fruit shake preparation activities (range 0-3).

The relations between changes in fruit and breakfast consumption and completeness of programme and element implementation were tested by mixed linear regression analyses for the individual posttests, with change scores of fruit or breakfast as outcome variables, and gender, ethnicity, SEP, year (first or second) and subtrack as fixed factors. The first analysis included completeness of programme implementation as a factor, while the second analysis included completeness of the implementation of the individual elements, including lesson 0 (range 0-1), the lessons on awareness (range 0-4), the practical activities (range 0-3), the advertisement lesson (range 0-1), the tests on the website (range 0-1), the magazine lesson (range 0-1), and the lessons on action plans (range 0-2). Comparable analyses were performed for the dichotomous outcome of sweet consumption, however instead of using change scores in outcome measures we

used the posttest scores on sweet consumption as an outcome measure and corrected for baseline intake.

Results

Response rates and participant characteristics

Eighteen (82%) of the 22 participating teachers completed the teacher logbook. They had implemented the lessons in 53 classes, in lessons on biology ($n=6$), care ($n=6$) or a combination both subjects ($n=6$), over an average period of 59 days ($SD=26.5$ days). Four teachers did not fill in the teacher logbook, which meant that 154 students in their classes were excluded from the study. Additionally, 66 students had to be excluded at the first posttest, and 87 were excluded at the second posttest, as they had been absent from the lesson in which the questionnaire was completed or had incomplete background characteristics, making it impossible to link the data of separate measurements. Analyses at the first posttest included a total of 897 students, while those at the second posttest included 876 students. Students who dropped out of the study were significantly more often second-year students ($OR=1.67$, $p<0.01$; CI [1.13-2.47]), and had consumed breakfast less frequently before programme implementation ($OR=0.91$, $p<0.05$; CI [0.83-0.98]).

Half of the participating students were male. The majority of the students were in the second year (60.0%), attended the higher educational subtrack (85.1%) and were of Dutch ethnicity (79.8%). The mean SEP score was comparable to the average Dutch SEP score (mean for participants=-0.05; Dutch mean=0.00 [scale 4 to -4; low to high]). The students included in the study had less than 5.0% missing values on all items, except for sweets consumption (missing values T1=8.0%; missing values T2=10.2%).

Changes in fruit, snack and breakfast consumption

Mean fruit consumption at baseline was 0.97 ($SD=0.78$) servings a day. A total of 58.6% of the students usually consumed sweets from the unfavourable category. At baseline, the mean number of days a week on which breakfast was consumed was 6.31 ($SD=1.61$).

Table 4.1 shows that mean fruit intake increased in the short term (+0.14 pieces a day) as well as in the longer term (+0.06 pieces a day). At the first and second posttest, 16.4% and 18.5% of the students, respectively, had shifted their usual sweets consumption from the unfavourable category towards the favourable category. The mean number of days on which breakfast was

consumed had decreased by 0.20 and 0.17 days a week at the first and second posttests, respectively.

Completeness of implementation of the programme and of specific programme elements

The mean score for completeness of programme implementation was 8.0 (SD=1.9; range 4.8-11.0). Table 4.2 shows that the lowest score for completeness of implementation was found for the action plan lesson (mean=0.47), while the fruit shake preparation activity was most fully implemented (mean=0.90). The first fixed lessons were implemented more completely than the later lessons.

Changes in dietary intakes in relation to completeness of implementation of the programme and specific programme elements

Table 4.3 shows the relations between the scores for completeness of implementation of the programme and specific elements and the short-term and longer-term changes in students' fruit, sweet and breakfast consumption. The score for completeness of programme implementation was significantly related to an increase in fruit consumption in the short term. The scores for completeness of implementation of the practical activities and the advertisement lesson were significantly related to an increase in fruit consumption in the short and longer term. No other significant relations were found.

Table 4.1 Changes in fruit, sweets and breakfast consumption

	First posttest compared to baseline				Second posttest compared to baseline			
	Mean (SD) change score	% of favourable change scores	% of unchanged scores	% of unfavourable change scores	Mean (SD) change score	% of favourable change scores	% of unchanged scores	% of unfavourable change scores
Fruit frequency (servings of fruit/ day)	0.14 (0.78)	45.4%	16.9%	37.7%	0.06 (0.78)	44.7%	16.5%	38.8%
Usual consumption of sweets	n.a.	16.4%	69.3%	14.3%	n.a.	18.5%	67.3%	14.2%
Breakfast frequency (number of days/ week)	-0.20 (1.57)	9.2%	66.9%	23.9%	-0.17 (1.72)	12.2%	66.9%	20.9%

n.a. = no mean change score could be calculated for dichotomous outcome measures

Table 4.2 Implementation rates and scores for completeness of implementation of programme elements, and the number of students whose dietary intakes were known and who were taught programme elements

Lesson	Programme elements	N (%) of teachers who implemented the lesson or activity	Scores for completeness of implementation (SD; range)
Fixed lessons			
1	Nutrition, foods and health	18 (100%)	1.00 (0.00) ^a
2	Fruit and fruit juices	18 (100%)	0.78 (0.21; 0.29-1.00)
3	Breakfast and snacking	18 (100%)	0.64 (0.25; 0.08-1.00)
4	Part 1: Barriers to healthy eating	15 (83%)	0.75 (0.27; 0.20-1.00)
6	Advertisements	15 (83%)	0.56 (0.25; 0.20-1.00)
7	Part 2: Personal action plans	15 (83%)	0.47 (0.30; 0.14-1.00)
8	Evaluation of personal plans	11 (61%)	1.00 (0.00) ^a
Optional activities			
0	Lesson on nutrients	15 (83%)	0.77 (0.20; 0.50-1.00)
5	Taste testing	17 (94%)	0.88 (0.22; 0.50-1.00)
5	Fruit tasting	4 (22%)	1.00 (0.00) ^a
5	Preparing a fruit shake	5 (28%)	0.90 (0.22; 0.50-1.00)
4/7	Tests on website	13 (72%)	1.00 (0.00) ^a
4/7	Magazine	14 (78%)	1.00 (0.00) ^a
Total programme completeness score			8.00 (1.90; 4.79-11.00)

^a Two lessons and two optional activities consisted of one activity only

Table 4.3 Completeness of implementation of the programme and the specific programme elements as predictors of changes in fruit frequency, snack consumption and breakfast frequency

phase	Implementation of the programme	short-term changes (T1-T0)			longer-term changes (T2-T0)		
		B's (CI) changes in fruit frequency	B's (CI) changes in breakfast frequency	Odds Ratio (CI) of sweets categories	B's (CI) changes in fruit frequency	B's (CI) changes in breakfast frequency	Odds Ratio (CI) of sweet categories
	Completeness of programme implementation (range 0-14)	0.05* (0.00-0.10)	0.03 (-0.05-0.12)	1.01 (0.92-1.11)	0.03 (-0.03-0.08)	0.04 (-0.06-0.14)	0.99 (0.90-1.09)
	Implementation of specific elements						
		B's (CI) changes in fruit frequency	B's (CI) changes in breakfast frequency	Odds Ratio (CI) of sweets categories	B's (CI) changes in fruit frequency	B's (CI) changes in breakfast frequency	Odds Ratio (CI) of sweet categories
-	Lesson 0 Nutrients (range 0-1)	0.09 (-0.15-0.32)	0.04 (-0.42-0.50)	1.18 (0.43-3.21)	-0.03 (-0.26-0.19)	0.01 (-0.48-0.48)	0.89 (0.32-2.43)
1	Lessons 1-4 Awareness and barriers (range 0-4)	0.01 (-0.14-0.15)	-0.03 (-0.31-0.25)	1.51 (0.49-4.66)	-0.02 (-0.16-0.12)	-0.09 (-0.40-0.21)	0.63 (0.20-1.94)
2	Lesson 5 Food exposure (range 0-3)	0.19* (0.04-0.34)	0.02 (-0.28-0.32)	1.41 (0.46-4.35)	0.26** (0.11-0.41)	-0.04 (-0.36-0.29)	1.13 (0.81-1.57)
2	Lesson 6 Advertisements (range 0-1)	0.43* (0.09-0.77)	-0.09 (-0.75-0.58)	1.54 (0.51-4.75)	0.62** (0.29-0.95)	-0.27 (0.98-0.45)	0.85 (0.27-2.66)
2	Magazine (range 0-1)	-0.30 (-0.62-0.03)	0.15 (-0.49-0.80)	1.68 (0.22-12.63)	-0.31 (-0.62-0.01)	0.46 (-0.23-1.15)	0.73 (0.10-5.43)
2	Tests on website (range 0-1)	-0.09 (-0.30-0.11)	0.38 (-0.02-0.79)	0.95 (0.69-1.31)	-0.10 (-0.30-0.10)	0.35 (-0.08-0.79)	0.73 (0.24-2.25)
3	Lessons 7-8 Personal plans (range 0-2)	0.13 (-0.05-0.31)	0.16 (-0.20-0.52)	0.77 (0.21-2.86)	0.17 (-0.01-0.35)	0.02 (-0.37-0.40)	1.59 (0.42-5.97)

Reported changes were corrected for a random intercept of class, and the fixed factors of gender, school year, educational track, SEP, and ethnicity * P<0.05; **P<0.001

Discussion

The first aim of this study was to investigate whether favourable changes in fruit and sweets consumption that were found in an RCT could be related to the completeness of the implementation of the Krachtvoer programme and the completeness of implementation of specific programme elements. The second aim was to examine whether unfavourable changes found in breakfast consumption could be related to the completeness of the programme implementation and the completeness of implementation of specific programme elements.

We found that the completeness of implementation of the programme was related to short-term, but not longer-term increases in fruit consumption. A possible explanation is that Krachtvoer, and the instrument used to measure its completeness of programme implementation, included not only elements addressing fruit consumption, but also to snack and breakfast consumption. Furthermore, completeness of implementation of the food exposure activities and the advertisement activity was related to both short- and longer-term changes in fruit consumption, implying that these elements made a unique contribution towards changes in fruit consumption. Increased fruit consumption was not only related to programme elements addressing fruit and fruit juices (i.e. taste testing, fruit tasting and preparation of a fruit shake), but also to a programme element which focused on environmental influences on food consumption in general (advertisement activity, applying advertisement tricks). These were all very practical activities, which were implemented with high levels of completeness by the teachers, and were appreciated better by the students than all other elements (Bessems, et al. submitted). This importance of practical activities is in agreement with the findings of a qualitative study that was held among students during the process of developing the programme, and that indicated the importance of tasting and recipe preparation activities (e.g. preparing a fruit shake), as well as other activities in which students were allowed “to doing things themselves” (Martens, et al., 2002). The importance of appreciation is in agreement with studies that also found appreciation to be related to changes in dietary intakes (Tak, te Velde, & Brug, 2009; Wind, et al., 2008). The key element of Krachtvoer seems to be that it uses practical and highly appreciated methods, which are effectively implemented by teachers. It is worth exploring if appreciation mediates the relation between programme outcomes and the completeness of implementation of certain activities.

We found no relations between sweets consumption and the completeness of implementation of the programme or specific elements, possibly because our outcome measure for sweets consumption lacked sensitivity. We recommend

studying this relation using a more sensitive item combining type of sweets and frequency of consumption.

Further, our findings indicate that the lack of effect on breakfast intake found in the RCT (Bessems, et al., submitted) was not attributable to incomplete implementation. This finding stresses the conclusion of the RCT, that our school-based educational intervention was unable to change breakfast consumption.

The current study had some limitations as well as some strengths. Overall, the number of implemented programme elements was quite high with limited variation in the completeness of implementation scores between teachers. This made it more difficult to answer our research questions. Using a sensitive score for completeness of implementation (counting the number of activities that were implemented in each programme element) enabled us to include the separate programme elements in our analyses that were implemented by all teachers (i.e. lessons 1-3). Still, if our sample had shown more variation regarding implementation scores of these lessons, a relation between the completeness of implementation of these lessons and the changes in dietary patterns might have been revealed as well. A strong point of our study was that we assessed the completeness scores for individual programme elements, which helped us distinguish the relative importance of individual programme elements. However, the implementation of these specific elements may have been related to other aspects which were not measured, such as teachers' enthusiasm and respect for students' opinions (Dusenbury, et al., 2003) or students' engagement (Ringwalt, et al., 2009), or may have been a result of multiple testing. However, the findings on the importance of full implementation of practical programme elements are consistent over time and in line with the findings of an earlier qualitative study (Martens, et al., 2002), and are therefore considered to be plausible. Another limitation was the use of logbooks to measure programme implementation. Although observational methods have been recommended to measure implementation (Durlak & DuPre, 2008), these are more time-consuming and hence were infeasible within the context of the current study. Completeness is only one element of the fidelity of programme implementation, and the present study did not assess programme adherence and quality, which have been shown to be related to outcomes of interventions to prevent drug abuse (Dusenbury, et al., 2003). We therefore recommend that future studies consider including assessment of completeness, quality, adherence, responsiveness and differentiation (Carroll, et al., 2007; Proctor, et al., 2011). However, the time investment required for this may be prohibitive for large research populations. Finally, we did not include control schools in the current study. This was because we were unable to

monitor the implementation of activities at control schools thoroughly enough, since they were using many different regular biology or care teaching programmes, or had produced their own teaching materials.

Conclusion

To conclude, our study has indicated the importance of stimulating teachers to implement the Krachtvoer programme to a high level of completeness, with a strong emphasis on the practical elements. To our knowledge, we are among the first to try and quantify the contributions of the implementation of particular programme elements to outcomes on dietary patterns. Although including the completeness of implementation of programme elements in an RCT is a challenge, we would still strongly recommend this for future studies. It can help distinguish a minimum required level of completeness of implementation, as well as distinguish which programme elements are essential, thus providing directions for programme implementation strategies. Further studies should explore appreciation as a mediator of the relation between the completeness of implementation of various types of activities and programme outcomes.

Chapter 5

Evaluation of an adoption strategy for a healthy diet programme for lower vocational schools

Bessemers KMHH, van Assema P, Paulussen TWGM & de Vries NK

Health Education Research 2011;26:89-105

Abstract

This paper describes the evaluation of an adoption strategy for the school-based healthy diet programme Krachtvoer. Health promotion professionals from five Regional Public Health Services in the Netherlands were asked to recruit a total of 25 schools to adopt the Krachtvoer programme in accordance with this strategy. Afterwards they were interviewed about their adherence to and subjective evaluation of the strategy. The adoption rate of the programme was calculated and ten adopting and nine rejecting teachers were interviewed about the reasons for their decision. The health promotion professionals' adherence to the strategy was good, as well as their appreciation and the perceived feasibility of the strategy. The person-to-person approach that characterized this strategy was considered important. The strategy led to an adoption rate of 53.2%. On average adopters mentioned 4.4 reasons and rejecters mentioned 5.4 reasons for their decision. Most reasons were school-related and programme-related, and in case of the adopters also teacher-related. The diversity of reasons revealed the complexity of teachers' decision making. Although there is some room for improvement of the adoption strategy and the programme itself, especially socio-political conditions in schools and in Regional Public Health Services need change for a further increase in programme adoption.

Introduction

Krachtvoer is a Dutch school-based healthy diet programme aimed at increasing the intake of fruit, promoting daily consumption of a healthy breakfast, and lowering the consumption of high fat snacks (Martens, et al., 2008). The programme was specifically developed for 12- to 14-year-old students of lower vocational schools, which have a relatively large proportion of students from lower socio-economic backgrounds. These students tend to have less healthy dietary habits and be more overweight than their peers with a higher socio-economic position (SEP), leading to a higher risk of developing chronic diseases like diabetes and cancer (RIVM, 2004; World Health Organization, 2005).

The Krachtvoer programme comprises eight class-room lessons, given by a biology or care teacher. The topic of nutrition is a standard component of both subjects. While subject of biology is more focused on technical knowledge (e.g. on nutrients), the subject of care focuses more on practical knowledge and skills (e.g. cooking skills). Krachtvoer is theory-based, and primarily, though not exclusively, uses insights from Self Management Theory (Boekaerts, et al., 2000), the Theory of Planned Behaviour (Ajzen, 1991), the Attitude-Social influence-Self Efficacy Model (de Vries, et al., 1988) and action planning literature (Sniehotta, 2009). Behavioural change methods include e.g. persuasive communication, modelling, practising skills, setting specific goals, and receiving feedback. The programme is supported by a combination of materials: a lunchbox with healthy food items, a work book, a magazine, postcards, posters, a website including a computer-tailored dietary advice, a recipe contest, and a take home bag for parents with a newsletter, a memo pad and healthy food items.

A previous experimental study showed that Krachtvoer is effective in increasing fruit consumption and decreasing the intake of high fat snacks (Martens, et al., 2008). In order to have public health impact, however, the programme needs to be adopted, implemented and continued on a large scale (Durlak & DuPre, 2008; Glasgow, 2008; Steckler & Linnan, 2002). We therefore developed a diffusion strategy for the programme, based on insights from the framework developed by Paulussen and colleagues (Paulussen, et al., 2007) which has been applied in a number of empirical studies in Dutch health care (Crone, et al., 2006) as well as in the Dutch education sector (Hoekstra, et al., 2007; Paulussen, et al., 1994; Wiefferink, et al., 2005). Additionally, insights from the Diffusion of Innovation Theory (Rogers, 2003), the Theory of Planned Behaviour (Ajzen, 1991) and Social Cognitive Theory (Bandura, 1986) were used for strategy development.

The diffusion strategy was developed for use by health promotion (HP) professionals of the Regional Public Health Services (RPHSs) in the Netherlands. RPHSs are local authorities responsible for health promotion in the Netherlands, including the support for school-based health promotion. This diffusion strategy consists of three sub-strategies, each targeting one of the three critical stages of teachers' innovation decision making: programme adoption, implementation and continuation (Paulussen, et al., 2007; Rogers, 2003). The present paper reports on the first part of the diffusion strategy: the adoption strategy.

Although the importance of diffusion research has been repeatedly underlined, we only found a limited number of papers describing and testing systematically designed strategies targeting the adoption stage of health promotion programmes in schools (Wiefferink, et al., 2005), including procedures for measuring adoption (Brink, et al., 1995; Buller, Buller & Kane, 2005; Hoelscher, et al., 2001; Johnstone et al., 2006; McBride, et al., 2007; Parcel, et al., 1995; Roberts-Gray, et al., 1998). Most of these studies only accounted for the number of adopting units (i.e. schools, people) after exposure to a strategy. In two studies, adoption failures were attributed to incomplete implementation of the adoption strategy (Brink, et al., 1995), and to the lack of a person-to-person approach (Buller, et al., 2005), respectively. None of the studies provided insight into the actual implementation of the activities of the adoption strategy. Overall, these studies emphasize the need for systematically designed and theory-based materials constituting an adoption strategy, such as recruitment brochures or other promotion materials. So far, studies into processes of adoption indicate that such materials should incorporate information about the instrumentality of the programme, e.g., information on the relative advantage and compatibility (Rogers, 2003), and theory-based persuasive strategies such as testimonies from various teachers (symbolic models) (Brink, et al., 1995; McBride, et al., 2007; Parcel, et al., 1995; Roberts-Gray, et al., 1998; Wiefferink, et al., 2005). Using only mailings and media attention appears to be less effective in achieving programme adoption than a person-to-person approach by a change agent (Brink, et al., 1995; Buller, et al., 2005; Hoelscher, et al., 2001; Johnstone, et al., 2006; McBride, et al., 2007; Roberts-Gray, et al., 1998). The importance of support by key decision makers in the region has also been shown (Blake, et al., 2005; Brink, et al., 1995; McBride, et al., 2007; Parcel, et al., 1995; Roberts-Gray, et al., 1998; Wiefferink, et al., 2005), as well as the importance of contacting both teachers and school managers (Brink, et al., 1995; Parcel, et al., 1995; Wiefferink, et al., 2005).

This paper presents the development and evaluation of the adoption strategy of the *Krachtvoer* programme. The research questions were:

1. To what extent did the HP professionals adhere to the adoption strategy?
2. Which barriers did they encounter when implementing the adoption strategy?
3. Which steps of the adoption strategy were considered to be most facilitating, and which were neutral or counterproductive for the intended adoption process?
4. How well was the handbook describing the adoption strategy used and appreciated by the HP professionals?
5. What was the adoption rate of Krachtvoer among schools as a result of the applied adoption strategy?
6. What reasons were given by teachers for their decision to adopt or not to adopt the programme?

Method

Adoption strategy

The development of the adoption strategy started by studying the literature on the process of adoption of school-based health promotion programmes and related determinants (Blake, et al., 2005; Brink, et al., 1995; Buller, et al., 2005; Butler, et al., 2008; Dunton, et al., 2009; Franks, et al., 2007; Fullan, 2001; Hoelscher, et al., 2001; Johnstone, et al., 2006; McBride, et al., 2007; McCormick, et al., 1995; Noonan, et al., 2009; Pankratz, et al., 2002; Parcel, et al., 1995; Paulussen, et al., 1994; Roberts-Gray, et al., 1998; Rohrbach et al., 2005; St Pierre and Kaltreider, 2004; Thaker, et al., 2008; Wiefferink, et al., 2005; Wilson and Wiley, 2009). Two recently applied diffusion strategies, one for a Dutch sex education programme (Wiefferink, et al., 2005) and one for a Dutch anti-bullying programme (Hoekstra, et al., 2007), provided a practical basis for further elaboration. In order to identify any salient barriers to adoption by schools in advance, a first draft of the strategy was presented to and discussed with 10 HP professionals and 11 teachers (Bessems, 2007). The draft strategy was perceived to be highly compatible with current practice, and only minor changes were made.

Based on the principles of the theoretical framework by Paulussen and colleagues (Paulussen, et al., 2007), the strategy assisted the HP professionals in dealing effectively with factors that were anticipated to be relevant to the intended adoption process in schools, i.e., characteristics of the innovation (e.g., appearance of the materials, topic, number of lessons), the user (e.g., outcome expectations for the programme, attitudes towards HP, teaching experience), the organization (e.g., school size, ongoing changes at the school), the socio-

political context (e.g., policies, epidemic of overweight) and the diffusion strategy (e.g., steps of the strategy, materials and image of the RPHSs) (Paulussen, et al., 2007).

Derived from various theories (Ajzen, 1991; Bandura, 1986; Paulussen, et al., 2007; Rogers, 2003) the adoption strategy materials used methods including principles of modelling (by means of testimonies from other teachers about their positive experiences with the programme), describing positive outcomes of using the prescribed classroom activities, convincing teachers of the compatibility both with national education targets and with the most commonly used textbooks for the relevant subjects of biology and care, and providing information on the instrumentality of the programme activities for active student participation.

The steps of the adoption strategy to be taken by the HP professionals were described in a handbook and are here presented in the first column of Table 1. The first steps are all preparatory steps, including receiving the programme and adoption strategy materials and preparing for recruitment (step 1), attending the one-day training course (step 2), becoming familiar with the current regional situation (step 3), writing a project plan for application of the diffusion strategy, including the adoption, implementation and continuation (step 4), dividing up tasks and informing colleagues (step 5), informing funding bodies and the public about the programme (step 6) and deciding on recruitment options (step 7). The subsequent steps involve the actual recruitment of schools, including sending personalized information to school teachers and school managers and contacting teachers by telephone (step 8), a visit to teachers who expressed an interest in the programme (step 9), followed by signing agreements about programme implementation (step 10).

The handbook included background information and instruments (e.g., model recruitment letters, presentations and checklists). The adoption strategy had a strong emphasis on a person-to-person approach; it strengthens the relation between HP professionals and teachers, which could serve as a basis for adoption, but also for later programme implementation and continuation (McCormick et al., 1995; Roberts-Gray, et al., 1998; St Pierre and Kaltreider, 2004; Wiefferink, et al., 2005).

Recruitment of RPHSs

The current adoption study was part of a larger research project also studying the evaluation of the stages of implementation and continuation as well as an evaluation of the effects of Krachtvoer on students' dietary behaviours by means of a randomized controlled trial (RCT). Initially, 10 of the 31 Dutch RPHSs were contacted for participation in the project. Five of the seven RPHSs

which agreed to participate were selected, from different parts of the country. To assure diversity in RPHSs the following criteria were set: including one RPHS supporting schools in an urbanized area, including one RPHS serving a relative small working area, and including one RPHS serving a relative large working area. Two additional RPHSs either actively applied the integrated 'healthy school' approach, or actively promoted the Healthy School Canteen project of the Netherlands Nutrition Centre. Two of the RPHSs had allocated one HP professional to the Krachtvoer project, while the other three had each allocated two HP professionals.

Recruitment of schools

Between February and June 2008, each RPHS was asked to recruit five schools that offered lower vocational education to at least 50 first- or second-year students, and that did not participate in another study of the RPHS. Recruitment took place in accordance with the steps of the adoption strategy. Steps 6 (informing funding bodies and the public) and 7 (deciding on recruitment options) of the adoption strategy were not applicable in this adoption study because of the accompanying RCT. A list of schools was available for each RPHS working area. The order in which schools were to be approached was determined at random by the research institute. This was done to prevent HP professionals from systematically selecting schools they had established working relations with or schools with the most severe nutrition and overweight problems. The proposed general meetings to inform schools (step 7a) were therefore not organized.

Evaluation of the adoption strategy and the handbook by HP professionals

Planned time investment for the adoption phase was 98 hours per RPHS. HP professionals were asked to keep records of time spend on the adoption process. Immediately after completing the adoption phase, the eight HP professionals were interviewed face-to-face to determine the level of adherence to the 10 steps of the adoption strategy. Additional questions were asked about the barriers they had encountered in completing these steps and the specific tasks related to the adoption and RCT study, and about the perceived influence of each step on the whole adoption process. The appreciation of the handbook was also discussed. The mean duration of the interviews was 67 minutes. The interviews were recorded, transcripts were made and texts were coded and analyzed with the NVIVO 8.0 qualitative data documentation and analysis software package (QSR International, Doncaster, Australia). The codes and classifications were checked by a second researcher.

Assessment of the adoption rate

The percentage of adopting schools was calculated by dividing the number of schools adopting the Krachtvoer programme by the total number of schools approached. Adoption was defined as signing an agreement to work with the programme.

Information on the number of students, on whether the school only offered lower vocational education or also other (higher) educational levels, and on whether the subject of care was taught in the first two years was derived from other data sources, for all adopting and rejecting schools. Statistically significant differences between adopting and rejecting schools were analyzed with the programme SPSS 15.0, using an independent t-test for school size, and chi-square tests for educational level and the subject of care being taught at school, respectively.

Reasons for adoption or rejection by teachers

As soon as the adoption decision had been made by a specific school, one of the teachers involved in the decision process was contacted for a telephone interview. Ten teachers representing adopting schools and ten teachers representing rejecting schools were approached for an interview within one to four weeks after making their decision. The interview started with an open question about the reasons which had influenced their adoption decision, followed by in-depth questions about those reasons. Further questions were asked about the subject that the teacher taught, the number of teachers teaching this subject at the school and whether the topic of nutrition was a structural part of the school's curriculum. The mean duration of the interviews was 18 minutes. The interviews were recorded, transcripts were made and texts were coded and analyzed with NVIVO 8.0 (QSR International, Doncaster, Australia). Reasons for programme adoption and rejection were clustered as suggested by the theoretical framework by Paulussen and colleagues, which states that teachers' innovation decision making is determined by the characteristics of the innovation, the intended user, the organization, the socio-political context and the characteristics of the applied diffusion strategy (Paulussen, et al., 2007). The codes were checked by a second researcher. Disagreements were discussed, resulting in consensus on all codes.

Results

Level of adherence to the applied adoption strategy by HP professionals

The average time spent on the adoption process was 94 hours per RPHS, with an average time investment of 18 hours per school. Table 5.1 shows considerable to high adherence to the following steps of the strategy: step 1 (preparing recruitment), step 2 (attending a one-day training course), step 5 (dividing up tasks and informing colleagues), step 9 (visiting schools), and step 10 (signing agreements). Steps 6 (informing the public and funding bodies) and 7 (deciding on recruitment options) were not applicable in this adoption study. Most deviations from the strategy occurred in step 3 (familiarizing yourself with the current situation), step 4 (writing a project plan), and step 8 (contacting schools personally). The availability existence of other healthy diet programmes and existing contacts with schools (step 3) were checked less thoroughly than was suggested in the strategy. Writing a project plan (step 4) was postponed since it was considered less important because clear targets for the larger research project had been set and funding was available. Most deviations occurred in contacting and informing schools (step 8), for example by not using the adoption brochure and sending non-personalized mailings to schools.

Barriers to adherence to the adoption strategy revealed by HP professionals

Some HP professionals mentioned the use of the randomized list to recruit schools and the prerequisites of the RCT as barriers to adherence to the adoption strategy. Most other barriers were faced in steps 3, 8 and 9. It was difficult to examine current programmes and contacts as suggested in step 3, since the available information was often not up to date. An important barrier in step 8 was that there were few contacts with biology and care teachers. In one region, the RPHS did not previously offer any HP programme to secondary schools at all: "One problem is that there are few relations between our RPHS and secondary schools. If schools knew the RPHS, it would be clearer what services we have to offer and we would be considered more as a partner organization". In two regions, HP professionals were able to use existing contacts with schools, but these contacts were merely with the management of schools, not with teachers. Although the youth care nurses from all RPHSs had contacts with teachers and school management, these contacts were often not with the care or biology teachers.

Table 5.1 Evaluation of the adoption strategy by HP professionals (n = 8 HP professionals from 5 RPHSs)

Step and details	Adherence (high-considerable-intermediate) ¹⁾	Barriers for this step	Influence of the step on adoption (Facilitating, neutral, interfering)
Step 1. Receiving programme and adoption strategy materials and preparing for recruitment Store programme materials for all schools Make yourself familiar with the Krachtvoer materials Read the RPHS handbook Find out what the prevalence rates are for obesity and unhealthy eating among youngsters	High	Long-term storage of programme materials difficult due to lack of storage space Overwhelming information and responsibility for an inexperienced health professional who just started working at the RPHS	Facilitating
Step 2. Attend the one-day training course Prepare questions about the programme or study Participate actively in discussions and a game on barriers to recruitment and possible solutions	Considerable: One RPHS dropped out after the training course due to unsuitable study conditions. A replacement RPHS missed the training course and received a personal introduction		Facilitating
Step 3. Familiarize yourself with the current situation in the region Find out which schools the RPHS has already established contact with, and use these contacts for the recruitment Find out which other healthy diet programmes are currently in use at schools Find out if there are secondary school networks in the region which can be used for communication ²⁾	Intermediate: Two RPHSs checked existing contacts with schools. Two only checked with close colleagues. One RPHS did not look at existing contacts at all. Three RPHSs did not check programmes beforehand but asked schools at the first contact.	It is difficult to identify programmes and contacts in a large RPHS Existing information was usually not up to date, since programmes and teacher tasks change regularly	Neutral to facilitating
Step 4. Write a project plan for the application of the diffusion strategy (including the adoption, implementation and continuation stage) Look at the example in the handbook Adjust the example to fit the situation at your RPHS	Intermediate: Three RPHSs did not complete the plan until the end of the recruitment period	One HP professional thought some information was lacking from the example and added it herself Time pressure due to later start of the adoption phase in one RPHS	Neutral to facilitating

Table 5.1 continued

Step and details	Adherence (high-considerable-intermediate) ¹	Barriers for this step	Influence of the step on adoption (Facilitating, neutral, interfering)
Step 5. Divide up tasks and inform colleagues Decide who is to be involved in the adoption process and divide up tasks Inform colleagues about the programme by e-mail or a meeting and / or show them the programme materials	High	In one region, schools were approached by colleagues from the RPHS who served as established contacts for the school management	Facilitating
Step 6. Inform funding bodies and the public³ Inform funding bodies of the RPHS Prepare a press release Put information on the website or in a newsletter	Not applicable in the adoption study	Not applicable in the adoption study	Not applicable in adoption study
Step 7. Decide on recruitment options Inform all schools through a regional school network or meetings ⁴ Approach schools personally	Not applicable in the adoption study	Not applicable in the adoption study	Not applicable in adoption study
Step 8. Send personalized information to the schools and contact teachers If the names of the biology and care teachers are unknown, call the school's administrative department to ask them the names Send a personalized letter and recruitment brochure to the biology and / or care teachers at each school Send a personalized letter and recruitment brochure to the school management Contact teachers by telephone or e-mail after one to two weeks	Intermediate: In three regions, this step was implemented in most cases, although one school could not be reached even after several attempts In two regions, schools were sent a letter or e-mail, sometimes without the recruitment brochure. One of the RPHSs used a general non-personalized mailing to 21 schools, including the Krachtvoer student workbook instead of the recruitment brochure Two RPHSs informed school managers. Two RPHSs only informed school management members whom they had contacts with. One RPHS did not inform the school management but asked the teachers to do so.	In one region, contacting schools through existing contacts with school managers worked well, but the decision process took longer In general, most RPHSs had limited or no contacts with the teachers Lack of awareness at one RPHS that the recruitment for Krachtvoer interfered with the recruitment for another RPHS programme Mailings got lost at some schools One RPHS was delayed and had to contact schools in a period with numerous free days and exams Teachers were difficult to reach between lessons Teachers seldom replied to messages from unfamiliar HP professionals The HP professional did not like to convince/bother schools HP professionals had to combine the recruitment with other tasks Lack of familiarity with the RPHS since it has no other health promoting activities on offer for secondary schools	Facilitating

Table 5.1 continued

Step and details	Adherence (high-considerable-intermediate) ¹	Barriers for this step	Influence of the step on adoption (Facilitating, neutral, interfering)
Step 9 Visit schools Visit teachers who have expressed an interest in the programme Show the materials, try to create enthusiasm and discuss conditions	High: Three adopting schools did not need a personal explanation and only received information by telephone	It is difficult to find a suitable moment for a meeting It is time-consuming to visit the schools	Facilitating
Step 10. Sign agreements Send a letter to the school with an agreement for collaboration Ask the manager to confirm the agreement by returning the signed agreement letter	Considerable: Four RPHSs sent the agreements to schools One RPHS changed the status of the contract into that of an informative e-mail without requirements	It is not common to sign formal agreements for programmes at RPHSs and schools This extra activity step took extra time	Interfering, neutral and facilitating
Participate in and support the adoption and RCT study Implement the adoption steps according to the protocol, including the use of the randomized list Approach only five schools at the same time, in the order indicated by the randomized list Approach new schools after rejection by the first ones. Stop the recruitment after five schools have adopted the programme Explain the study conditions to schools Participate in the study by informing the researcher and participating in an interview	Two RPHSs recruited four schools instead of five. To compensate for this shortage, a third randomized RPHS recruited seven schools in consultation with the researchers As the deadline approached, all RPHSs had approached more than five schools to meet the goals	Some teachers are sceptical about the study Recruiting five schools at once according to the list was complicated, time-consuming and not always in line with RPHS policy	Interfering, neutral and facilitating

¹High adherence: No changes were made to the elements of the step
Considerable adherence: Changes made interfered with one of the key elements of the step
Intermediate adherence: Changes made considerably interfered with several of the key elements of the step
² Step 3c: Step 3c was not necessary, since in the adoption study, schools were only recruited by a person-to-person approach, to be able to calculate the adoption rate.
³ Step 6: Step 6 was not implemented in this adoption study, to prevent intervention contamination at the control schools
⁴ Step 7a: No communication through regional networks or meetings was organized due to the study conditions imposed by the large RCT. Schools were contacted personally.

The HP professionals did not want to bother their colleagues with questions on existing contacts with schools, so these were often not utilized. A major barrier to the person-to-person approach intended in steps 8 and 9 was that it was perceived as too laborious and time-consuming. Teachers could only be phoned in between lessons, when they were often not near a telephone: "Teachers are difficult to reach since they are teaching all day. If you ask them to call back, they often don't. So you have to try over and over again." Some HP professionals felt like sales representatives if they had to repeatedly try and reach busy teachers. It made them feel uncomfortable and they did not perceive this to be part of their task. HP professionals further indicated that teachers with whom they had already had contact before, were often more active in returning calls. Since some RPHSs had relatively large service areas, travelling to the schools was sometimes time-consuming.

Subjective evaluation of the relevance of the adoption strategy by the HP professionals

The HP professionals perceived steps 1, 2, 5, 8 and 9 to be facilitating the adoption process in schools, i.e., reading the programme materials, attending the one-day training course, dividing up tasks and informing colleagues, contacting schools and visiting the schools. The HP professionals had mixed opinions about steps 3, 4 and 10 (becoming familiar with the programme, writing the project plan and signing formal agreements with the schools).

One HP professional explained why she had perceived the training course (step 2) to be facilitating: "The training course facilitated the whole process. It made me feel more confident since I had practiced the meeting and we discussed how problems could be tackled." However, some more experienced HP professionals considered the training course to be useful for less experienced colleagues, but not necessarily for themselves. Since the whole Krachtvoer training course covered three training days (preparing the adoption, implementation and continuation phases separately), it was considered to be too long by some HP professionals.

All HP professionals considered the proactive person-to-person approach of steps 8 and 9 to be necessary to motivate teachers to work with the programme. One HP professional said: "Personally I think it is nice to meet teachers in person. In fact, it is necessary for the project to succeed." The HP professionals reported that teachers became more involved after having seen the materials and having discussed the programme. They also became more aware of the behavioural change goals (compared to the usual knowledge goals) and the prerequisites of the project, like attending a 2-hour introduction meeting on the Krachtvoer programme.

Some HP professionals motivated the importance of writing a project plan (step 4) by arguing that it had made them more aware of the diffusion process. One HP professional mentioned that the plan was important in case another colleague should have to replace her during a longer period of absence. HP professionals from two other RPHSs considered it unnecessary to write a project plan, because they participated in the larger research study, which meant that there was no need to secure extra financial resources. With regard to signing written agreements (step 10), some HP professionals indicated that this made them feel uncomfortable, as it was not compatible with current working methods, which were usually informal. One HP professional commented: "I'm afraid that teachers may feel pinned down. But I did not really hear that from the schools, so maybe it's just my own idea". Others mentioned that discussing the possibilities and conditions set out in the written agreement had created clarity. Finally, all HP professionals said that the adoption study had influenced the whole adoption process. The recruitment of schools according to a randomized list, had slowed down the adoption process. Other steps had been implemented differently due to conditions of the accompanying RCT, including the lack of publicity which was not always in line with standard RPHS policy. Then again, some schools could have adopted the programme because the materials were free of charge in the context of the research project.

Appreciation and use of the handbook by HP professionals

The handbook was well appreciated by all HP professionals. All of them had used the checklists, the examples of recruitment letters and other materials regularly.

Adoption rate of schools

Of the 47 schools which were contacted 53.2% (25) had decided to adopt the programme; 10.6% (5) had not decided before the deadline and were therefore considered rejecters, and 36.2% (17) had explicitly rejected the programme. No statistically significant differences were found between the 25 adopting and 22 rejecting schools in terms of school size, presence of higher levels of education at the school and whether care was taught as a subject.

Reasons for adoption or rejection according to teachers

A total of 10 teachers of adopting schools and 9 teachers of rejecting schools participated in the telephone interviews. One other rejecting teacher sent an e-mail stating that he had rejected the programme and was therefore not willing

to participate in the telephone interview either. Adopters spontaneously mentioned an average of 4.4 reasons for their adoption decision, while rejecters mentioned an average of 5.4 reasons for their decision (Table 5.2).

Reasons given by adopters were predominantly programme-related, teacher-related and school-related. Programme-related reasons included the perceived added value of the programme compared to the current programme, the possibility to combine the programme with the current biology or care lessons, and the attractiveness of the materials: "The materials look nice! This practical approach fits students perfectly." Common teacher-related factors were previous favourable experiences with projects from external organizations, and personal interest in nutrition. One teacher commented: "Personally I think the topic of nutrition is very important. I'm well aware of my own intakes and think it's important to make students aware and enthusiastic about the topic as well." The flexibility of the school curriculum and perceived support from colleagues to work with the Krachtvoer programme were often reported as school-related reasons. Reasons relating to the socio-political context, the adoption strategy and the individual HP professional were mentioned less often, although the proactive person-to-person approach of the HP professional was mentioned by three teachers as a one of the reasons for programme adoption.

Rejecters predominantly mentioned school-related and programme-related reasons for their decision. The current use of another programme to teach about nutrition and the inflexible school curriculum, offering little room for external projects, were frequently mentioned by rejecting teachers. One teacher said: "There are just two hours to teach care and biology each week. If we wanted to add an external project, it would mess up our whole school curriculum!" Frequently mentioned programme-related reasons were the perceived lack of added value of Krachtvoer in comparison to currently employed programmes and the large number of lessons. One teacher stated: "Two years ago I developed a nutrition programme, which I enjoy teaching a lot. My own programme is more complete than the Krachtvoer programme, which does not focus on food etiquettes for example." Socio-political and teacher-related reasons were mentioned less often by rejecters, although two teachers reported to have been influenced by the many offers of educational materials and projects by external organizations and the trend towards holding schools responsible for solving society's problems. One teacher stated: "Every week I receive mailings with brochures and teaching materials. It is just too much! If I used all those materials, I would not have enough time to work with the regular book." No one stated that the adoption strategy had been decisive in their rejection of the programme.

Table 5.2 Reasons for adoption and rejection mentioned by adopting and rejecting teachers

Reasons for adoption (n = 10 teachers)		Reasons for rejection (n = 9 teachers)
Context	<ul style="list-style-type: none"> - Teacher is worried about the overweight epidemic (n=1) 	Context <ul style="list-style-type: none"> - Schools are frequently offered programmes by many organizations (n=2) - Trend towards making schools responsible for solving society's problems such as health (n=2) - Teacher perceives pressure to meet primary educational targets (n=1)
Teacher	<ul style="list-style-type: none"> - Teacher regularly works with external programmes and likes to try something new (n=7) - Teacher perceives it his/her task to make students aware of healthy eating (n=2) - Teacher has favourable experiences working with the RPHS (n=1) - Teacher has a personal interest in the topic of nutrition (n=4) 	Teacher <ul style="list-style-type: none"> - Teacher has unfavourable experience with programmes from external organizations (n=1) - Teacher does not perceive health education and behaviour change to be his task (n=1) - Teacher has sufficient knowledge of the topic and therefore does not need a new programme (n=1)
Krachtvoer	<ul style="list-style-type: none"> - Krachtvoer offers added value (in terms of behaviour change, practical lessons, students' ability to relate to the materials, completeness of the programme, no cooking facilities required) (n=6) - Krachtvoer can be combined with current lessons (n=4) - The Krachtvoer materials are attractive to students (n=4) - Teacher hopes or expects that Krachtvoer will be effective (n=2) 	Krachtvoer <ul style="list-style-type: none"> - Krachtvoer does not offer added value compared to the current school curriculum (no additional information compared to the current programme, less information than the current programme, teacher has to teach the lessons herself) (n=4) - Future costs of the programme (n=1) / new materials each year (n=1) - The programme is still experimental (n=1) - Too many lessons (n=3)
School	<ul style="list-style-type: none"> - The current programme is old or costly (n=2) - Currently there is a lot of attention for the topic of nutrition at the school (n=1) - Currently there is little attention for the topic of nutrition at the school (n=1) - The school curriculum is flexible, with room for other programmes (n=4) - The school is innovative and likes to participate in new programmes (n=1) - Teachers experience support / interest from colleagues (n=3) - Students like the topic of nutrition (n=1) 	School <ul style="list-style-type: none"> - Teacher uses a different programme (n=8) - There is already a lot of attention for nutrition at this school (n=1) - Students already eat healthy diets (n=2) / high SES students with few nutritional problems (n=1) - Unclear who will teach the subject next year (n=1) - Colleague is sick (n=1) - The school has other priorities (n=2) - Inflexible school curriculum with little time for other programmes (n=8)
HP professional and strategy	<ul style="list-style-type: none"> - Proactive approach of the HP professional (n=3) - Enthusiasm of the HP professional (n=1) 	HP <ul style="list-style-type: none"> - No reasons mentioned
Study	<ul style="list-style-type: none"> - No reasons mentioned 	Study <ul style="list-style-type: none"> - Study burden (n=1)

Discussion

This adoption study aimed to evaluate the level of adherence among the HP professionals to an adoption strategy for a healthy nutrition programme, to assess HP professionals' subjective evaluation of that strategy, and the strategy's success rate, and to explore teachers' reasons for their decision to adopt or reject the programme.

Overall, the HP professionals' adherence to the intended adoption strategy was considerable. The steps that were less fully adhered to were not considered to be important for the adoption process by all professionals (step 3, becoming familiar with the situation, and step 4, writing a project plan) or were affected by major barriers (step 8, contacting and informing schools). The person-to-person approach of steps 8 and 9 was, however, considered to be very important in the recruitment process by all HP professionals. The handbook that described the adoption strategy and the recruitment materials that were offered were well appreciated and were used regularly when applying the adoption strategy. The importance of the person-to-person approach has been reported in several other studies as well (Franks, et al., 2007; Hoelscher, et al., 2001; Roberts-Gray, et al., 1998; Thaker, et al., 2008).

The adoption strategy resulted in an adoption rate of 53%. We consider this a very acceptable result, although we cannot refer to a control condition applying alternative approaches or to a norm derived from several comparable studies.

The complexity of the adoption decision process was revealed by the numerous and diverse reasons that teachers mentioned for their schools adoption decision. Adopters and rejecters differed especially in terms of school-related factors (e.g. the perceived flexibility of the school curriculum), innovation-related factors (e.g. the perceived added value of *Krachtvoer* compared to the programme they were already using), and factors related to the socio-political context (e.g. resistance to the trend of making schools responsible for solving society's problems). Adopters were also more likely to mention teacher-related factors as reasons for adopting the programme. A possible explanation for the limited number of teacher-related reasons mentioned by rejecters might be social desirability. Overall, these findings reveal major differences between programme adopters and rejecters, covering the different various aspects of the framework and providing reasonable explanations for their adoption or rejection decisions.

The diversity of factors found to influence the adoption decision is in line with the theoretical model by Paulussen (Paulussen, et al., 2007) and the findings of other studies. Factors mentioned as influencing adoption decisions

in other studies were innovation-related factors, such as programme complexity (Pankratz, et al., 2002; Rohrbach, et al., 2005; Wilson and Wiley, 2009), relative advantage (Pankratz, et al., 2002; Parcel, et al., 1995; Rohrbach, et al., 2005), compatibility with current strategies (Noonan, et al., 2009; Rohrbach, et al., 2005) and perceived programme effectiveness (McBride, et al., 2007; Rohrbach, et al., 2005). Since the Krachtvoer programme is relatively easy to implement (Martens, et al., 2006), programme complexity was not mentioned in our study. Teacher-related factors found to influence adoption decisions include self-efficacy, attitudes (Parcel, et al., 1995) and a sense of responsibility for prevention (Noonan, et al., 2009; Paulussen, et al., 1995). Other factors found to influence programme adoption decisions include environmental factors, such as school-related factors (including the use of a different programme (St Pierre & Kaltreider, 2004; Thaker, et al., 2008; Wilson & Wiley, 2009), supportive school climates and shared decision making (McCormick, et al., 1995; Paulussen, et al., 1995; Rohrbach, et al., 2005), lack of time to fit the programme into the school curriculum (St Pierre & Kaltreider, 2004; Thaker, et al., 2008) and changes within the school (Thaker, et al., 2008)), and socio-political factors (such as support from a change agent / organization (McBride, et al., 2007; Parcel, et al., 1995; Rohrbach, et al., 2005) and resource allocation (McBride, et al., 2007; Rohrbach, et al., 2005)). Although financial costs were no issue in our study since the programme was free of charge in the research project, all other teacher related, environmental and socio-political factors were mentioned in our study as well.

One limitation of the study part among the HP professionals (answering research questions 1 to 4) was the small study population (eight professionals from five RPHSs). However, given the diversity of RPHSs participating in this adoption study, we believe that the results can be generalized to other such services in the Netherlands, despite the fact that none of the participating RPHSs was active in the four largest cities in the Netherlands. Another limitation was that although the interviews were all held immediately after the adoption phase and allowed detailed discussion and in-depth questioning, recall problems and social desirability may have influenced the answers. A specific limitation relates to the classification of the level of adherence to the steps by the HP professionals. Although the classifications were defined beforehand, it was in some cases questionable if changes that were made to the implementation had interfered with the focus of a step. The most important limitations are related to the generalizability of the results. The requirements for participation in this particular study (e.g. recruitment of schools according to the randomized list, and explaining demands of the RCT to schools) may have increased the complexity of the adoption process. Without the conditions

imposed by the accompanying studies, HP professionals probably would have selected schools they had established working relations with. As a consequence, the person-to-person approach would probably have been even more facilitating and faced with fewer barriers, since HP professionals indicated that the teachers they knew personally were more responsive to their requests. Furthermore, the time that HP professionals could spend on implementing the strategy may have been shorter than in a real-life situation, due to competing study-related tasks. On the other hand, participation in the trial may also have stimulated the investment of more time and effort in the implementation of the strategy, since some HP professionals wanted the RCT to succeed. Finally, some adoption steps were not implemented or evaluated due to the RCT, specifically step 6 (informing funding bodies and the public), and due to the assessment of the adoption rate, i.e. step 7a (informing schools through a network meeting). The use of networks is known to influence the diffusion process (Hoelscher, et al., 2001; Rogers, 2003).

Some weaknesses of the study parts among schools (answering research questions 5 and 6) should be considered as well. Since schools were recruited in a randomized order, it is unlikely that selection bias has affected the adoption rate, i.e., that the HP professionals only approached the schools easiest to get. However, the adoption rate in our study might not truly reflect real-life adoption rates because schools were not only recruited for the adoption of *Krachtvoer*, but also for participation in a RCT. This implied the possibility of ending up in the waiting list control condition. Some teachers mentioned the fact that the programme was still in an experimental phase as a reason for their positive or negative adoption decision. Study-related issues were also reported as reasons for rejection in a study by St. Pierre et al. (St Pierre & Kaltreider, 2004). Furthermore, the programme was delivered free of charge in the context of the RCT, while in real-life, schools will have to pay for the programme. Finally, the study among teachers was also limited by a small sample and possible recall problems.

A number of constraints towards programme adoption have been identified in this study. Socio-political factors influencing the contribution of the HP professionals, such as limited HP capacity and related time constraints, cannot be overcome in the short term. In view of the current time investment per school, it is questionable if it is feasible to target a large number of schools in a real-life setting. This issue could be addressed by means of combined recruitment for more evidence-based interventions, as RPHSs have the task to promote several HP programmes in schools. This makes good registration systems of programmes for RPHSs even more necessary. We suggest that RPHSs should focus on a person-to-person strategy, maintaining relations with

schools, preferably with fixed HP professionals for each school, not only during the adoption phase of programmes, but also during later programme implementation and continuation, as is done in the integrated “Schoolbeat” approach (Boot, et al., 2010a).

Suggestions for improvement of the steps of the strategy include instructing HP professionals how to persuade teachers to involve the school management and incorporate the innovation in the school’s health policy, and presenting the written agreement in a favourable light to ensure continued cooperation between the RPHS and the school and to encourage programme continuation.

Programme-related constraints including issues of programme materials storage can be prevented by direct deliveries to schools by the coordinating organization. Other programme-related reasons that were mentioned for rejecting the programme related to issues that had been carefully considered during the programme development and the first RCT (Martens, et al., 2002; Martens, et al., 2005). Changes to the programme are not being considered at this stage, so as not to disturb the balance between optimal programme implementation and programme effectiveness (Martens, et al., 2006; Martens, et al., 2008).

It would also be useful to consider how to deal with the constraints relating to the socio-political context of schools. The Ministry of Education has set rather globally defined targets for secondary education. The subject care is no longer obligatory and therefore a lot of schools combine it with biology, which reduces the number of teaching hours.

Also, there is no legal obligation for implementing schools health promotion programmes. Under these circumstances, HP professionals have to rely on a good strategy, including optimizing their persuasion skills, to motivate teachers to work with health promotion programmes, which are considered to be supplementary to the core curriculum. Similarly, we recommend that RPHSs focus especially on high quality implementation and continuation in the adopting schools, and less on trying to convince schools in which where circumstances for HP programme adoption are far from optimal (e.g. low curriculum flexibility and high resistance towards external programmes).

This study is one of the few targeting the systematic evaluation of an adoption strategy, and the only one to include a process evaluation of the strategy as well as its success rate and the reasons for adoption or rejection. In spite of limitations, we conclude that our findings show good appreciation, feasibility and an acceptable success rate of the adoption strategy applied. A possible explanation for the success is the planned and theory-driven approach used in developing the adoption strategy.

It is important to know how we can support the adoption of effective interventions in practice. This study showed that the person-to-person approach of the adoption strategy resulted in half of the schools adopting the Krachtvoer programme. Although there is some room for improvement of the adoption strategy and the Krachtvoer programme itself, especially socio-political changes in schools and RPHSs will further improve its adoption. Further progress towards the diffusion of health promotion interventions will require more high-quality studies in this area, especially in a non-experimental setting.

Chapter 6

Determinants of completeness of teachers' implementation of the Dutch school-based Krachtvoer healthy diet programme

Bessems KMHH, van Assema P, de Vries NK & Paulussen TWGM

Submitted for publication

Abstract

Strategies to promote high quality implementation of school-based health promotion programmes should be designed to suit determinants of completeness of implementation and continuation. We studied determinants of completeness of implementation by teachers, and their intention to continue the Dutch 'Krachtvoer' healthy diet programme.

Completeness of programme implementation was assessed among 21 teachers of 13 schools by means of logbooks. Baseline and posttest questionnaires were used to assess user-, programme-, context- and dissemination strategy-related determinants and teachers' intention towards programme continuation. Non-parametric tests and logistic regressions were used to assess baseline differences between teacher who implemented the programme with low and high levels of completeness, posttest differences between teachers with low and those with high intention to continue the programme, changes in determinants between teachers with non-increased and those with increased intention to continue the programme, and baseline–posttest differences in the whole group. Low implementers scored lower on the teacher-related determinant of 'self-efficacy' and the context-related determinant of 'subjective norm from colleagues' than high implementers. Low intenders scored lower on some user- (e.g. 'perceived outcome importance'), programme- (e.g. 'compatibility') and context-related determinants (e.g. 'subjective norm from students') than high intenders. Non-increased intenders scored lower on some user- (e.g. 'perceived personal benefits') and context-related determinants (e.g. 'social support from coordinator at school') than increased intenders. The group of teachers as a whole showed some favourable and some unfavourable baseline–posttest changes in terms of user-, programme- and context-related determinants. The results imply that various user-, programme- and context-related determinants should be addressed to improve completeness of teachers' programme implementation and continuation.

Introduction

School-based healthy diet programmes can effectively change dietary habits (van Cauwenberghe, et al., 2010). To achieve a public health impact, however, these efficacious programmes need to be adopted on a large scale, implemented with acceptable levels of fidelity and continued as intended (Durlak & DuPre, 2008; Dusenbury, et al., 2003). Unfortunately, programme adoption does not always lead to high quality implementation, so it is critically important to examine determinants of implementation and continuation. We studied implementation-related determinants during a pilot implementation project of a Dutch school-based healthy diet programme called *Krachtvoer*. The project tried to achieve complete and faithful programme implementation by developing an implementation strategy which was carried out by health promotion (HP) professionals of Dutch Regional Public Health Services (RPHSs).

The conceptual framework for the present study was derived from studies in health care and in school settings, which indicated that diffusion processes are influenced by a combination of determinants (Durlak & DuPre, 2008; Dusenbury, et al., 2003; Fleuren, Wiefferink, & Paulussen, 2004; Han & Weiss, 2005). We categorized these determinants into user-related determinants (e.g. skills), programme-related determinants (e.g. compatibility), context-related determinants (e.g. school size) and dissemination strategy-related determinants (e.g. training). The present study aimed to generate recommendations to improve the implementation strategy applied in the pilot implementation project. Specific research questions were:

1. What determinants are associated with the completeness of teachers' implementation of the *Krachtvoer* programme, and with their intention to continue the programme and possible changes in these intentions?
2. Do these determinants change as a result of teachers' experiences with the programme implementation?

The Krachtvoer programme and implementation strategy

Krachtvoer is a Dutch school-based healthy diet programme for students attending the first two years of prevocational school. Its aims are to increase fruit consumption, to promote the daily consumption of a healthy breakfast, and to reduce the consumption of high-fat snacks. The programme comprises eight class-room lessons which are taught by teachers of biology and/or care. While subject of biology is more focused on technical knowledge (e.g. on nutrients), the subject of care focuses more on practical knowledge and skills (e.g. cooking skills). The programme includes fixed lessons (i.e. lessons with a

fixed protocol) and optional activities, and is accompanied by a teacher manual. The main instrument is the student work book, which is supported by some additional materials, such as a website. Some examples of the theory-based methods being applied are modelling and goal setting (Bessems, et al., submitted).

The implementation strategy is part of a broader dissemination strategy, aimed at the promotion of programme adoption, implementation and continuation (Rogers, 2003). This dissemination strategy takes account of the determinants defined by the innovation process framework by Paulussen et al. (2007) and is based on two recently completed Dutch dissemination studies (Hoekstra, et al., 2007; Wiefferink, et al., 2005) and additional literature. The Krachtvoer implementation strategy comprises four elements. The first element is *teacher involvement* in programme development (Butler, et al., 2008; Sy & Glanz, 2008), in order to ensure that the programme (in terms of layout, content, costs and number of lessons) is compatible with teachers' needs, their classroom routines and the national education targets, and includes optional learning activities (Durlak & DuPre, 2008; Dusenbury, et al., 2003; Jourdan, et al., 2010; Rohrbach, et al., 2006). The second element is *teacher training*. Training aimed to increase teachers' insight into the programme methods and strategies and increase their self-efficacy, and used modelling techniques and promoted positive expectations about programme implementation (Buston, et al., 2002; Durlak & DuPre, 2008; Dusenbury, et al., 2003; Kealey, et al., 2000; Rohrbach, et al., 2006). The third element involves creating a *favourable school climate*, including a supportive coordinator at school, supportive colleagues, a programme champion or coordinator and students' support (Beets, et al., 2008; Durlak & DuPre, 2008; Dusenbury, et al., 2003; Gregory, et al., 2007; Hoelscher, et al., 2001; Jourdan, et al., 2010; Leurs, et al., 2007; Rohrbach, et al., 2006; St Pierre & Kaltreider, 2004). The final element is arranging the ongoing support of, or contact with, a change agent (Durlak & DuPre, 2008; Hoelscher, et al., 2001; Noonan, et al., 2009; Rohrbach, et al., 2006).

During the pilot implementation project, the HP professionals from the RPHSs received a handbook describing the steps in the Krachtvoer implementation strategy, and were offered instruments such as presentations, checklists and background information. In a one-day group training session, the HP professionals discussed the programme in detail, practiced skills, provided and received feedback, and brainstormed about possible barriers that would impede them in supporting schools during teachers' implementation of Krachtvoer, as well as ways to deal with these barriers. As a first step in the implementation strategy, the HP professionals organized a 2-hour kick-off meeting for teachers in their region, informing them about core programme

features, and the kind of external support that had to be provided by the RPHS. The HP professionals used persuasive communication and modelling to try and create enthusiasm for programme implementation and continuation, as well as to stimulate teachers to discuss the programme with others in their schools. During the actual implementation of the Krachtvoer programme, the HP professionals contacted the teachers periodically by e-mail or telephone to discuss their progress, to remind the teachers that they could contact them in case of difficulties, and to stimulate discussions with colleagues and their coordinators.

Methods

Participants and data collection methods

This study was part of a larger pilot implementation project examining the overall dissemination process of the programme (Bessems, et al., 2011) and the programme's effects (Bessems, et al., submitted). HP professionals from five RPHSs recruited 13 prevocational schools. Krachtvoer was implemented in these schools by 22 teachers in 53 classes with about 1100 students. Completeness of implementation was assessed by asking teachers to fill in a logbook of activities after each lesson. They also filled in a baseline questionnaire before the kick-off meeting and a posttest questionnaire after the programme implementation.

Measures

Completeness of implementation was measured by having teachers indicate which programme elements (fixed lessons and optional activities) they had implemented. For each of the 14 programme elements, teachers could tick off the activities they had implemented, on a list of all proposed activities. A score for *completeness of element implementation* (range 0-1) was calculated by dividing the number of implemented activities by the number of proposed activities within that programme element. A score for *completeness of programme implementation* (range 0-14) was calculated as the sum of the completeness scores for the activities of each programme element. *Intention to continue the programme* in the next school year was assessed by one item at baseline and posttest (five-point scale from 'no, certainly not' to 'yes, certainly').

The questionnaires also contained questions on 27 potentially relevant implementation-related determinants, selected from a large list of possible determinants, which had been derived from the literature, from findings of an

earlier Krachtvoer adoption study (Bessems, et al., 2011) and from a comparable study on an innovation in health care (Crone, et al., 2006). The determinants included ten user-related (i.e. teacher-related) determinants, five programme-related determinants, nine context-related (i.e. school-, student- and parent-related) determinants, and three dissemination strategy-related determinants. Five programme-related concepts were derived from Rogers' Diffusion of Innovation Theory (Rogers, 2003), while other specific items were derived from a study on the implementation of a Dutch school-based sex education programme (Wiefferink, et al., 2005). Baseline and posttest questionnaires were similar, except that permanent determinants (e.g. gender, teaching subject) were only assessed at baseline. Answers were given on five-point Likert-type scales (-2 to 2) unless mentioned otherwise. The answering options varied between the items (e.g. 'totally disagree' to 'totally agree'; 'no, certainly not' to 'yes, certainly'; 'very unimportant' to 'very important').

With regard to user-related determinants, an overall mean score for self-efficacy towards programme implementation was calculated using 16 items (e.g. 'I can lead discussions in such a way that students feel free to participate if they want to'; Cronbach's $\alpha = 0.87$). A mean score for perceived personal benefits was calculated based on 4 items (e.g. 'I expect that I will be able to use the programme strategies effectively in lessons on other topics'; Cronbach's $\alpha = 0.78$). Modelling behaviour was measured by one item ('I try to set a good example for students'). Outcome expectations were measured in terms of the perceived importance and feasibility of the programme-related student learning outcomes. Mean scores were calculated based on eight five-point scale items (e.g. 'How important is it for you that students eat a healthier diet?'; Cronbach's α outcome for importance = 0.88, and 'Do you expect that students will eat a healthier diet as a result of the lessons?'; Cronbach's α for outcome feasibility = 0.89). Teachers' perception of task responsibility as regards students' dietary intakes were measured with two items asking whether this was the responsibility of students or parents, and two about the teacher's responsibility (e.g. 'It is my responsibility as a teacher to stimulate students to improve their dietary intakes'). Questions about teachers' background characteristics related to gender, years of teaching experience, the subject they taught and the number of classes in which they taught the Krachtvoer programme.

Questions on programme-related determinants included 'relative advantage', which was assessed by eight items (e.g. 'The programme is flexible enough'; Cronbach's $\alpha = 0.80$). Other items related to low programme complexity (i.e. 'The lessons involve a classroom organization which can be managed by most teachers'), compatibility (i.e. 'Krachtvoer fits in with the

subject I teach'), trialability (i.e. 'Participating in this pilot is a good way to find out if Krachtvoer suits my school') and observability (i.e. 'Participating in the Krachtvoer pilot is a good way for my school to distinguish itself').

Context-related determinants included school-, student- and parent-related items. Perceived subjective norms and social support for programme implementation were assessed with regard to colleagues teaching the same subject, the relevant coordinator at school, students and parents (e.g. 'How important do students find it that you teach the Krachtvoer lessons?' and 'To what extent do you expect support from students for the lessons?' with answers ranging from 'a lot of support' to 'a lot of opposition'). Teachers' estimation of the percentage of students who would meet the fruit and breakfast recommendations was assessed by asking for the percentage of students who, in the respondent's view, consumed two servings of fruit a day and a daily breakfast, respectively ('less than 25%', '25-50%', '50-75%', '75-100%'). Teachers were also asked to estimate the number of snacks students ate per day. School size was defined as the number of students attending the school. The presence of a school health policy was assessed with one item ('there is a printed plan', 'there are oral agreements' or 'there are no agreements'). The healthiness of the products offered by the school's canteen and vending machines was assessed by two items (with answering options 'mainly healthy products' and 'mainly unhealthy products').

Regarding the dissemination strategy, teachers were asked with one item about their satisfaction with the support they had received from the RPHS during the programme implementation ('very dissatisfied' to 'very satisfied'). The final three yes/no items assessed the teacher's involvement in the Krachtvoer adoption decision, and whether the programme had been discussed with colleagues and the relevant coordinator at school.

Statistical analyses

Statistical analyses were conducted using PASW Statistics 17 (SPSS Inc. Chicago, IL).

Teachers who scored below the average score for completeness of programme implementation were defined as 'low implementers', the others as 'high implementers'. Teachers with a positive intention at posttest to continue the programme were defined as 'high intenders', while teachers with a neutral or negative intention were defined as 'low intenders'. Finally, change scores for intention to continue the programme were calculated (posttest intention score minus baseline intention score). Teachers with decreased or unchanged intention scores were defined as 'non-increased intenders', while teachers with increased intentions were defined as 'increased intenders'.

Differences between groups of teachers were tested using Mann–Whitney U tests for continuous outcomes and single logistic regressions for dichotomous outcomes. We first tested for baseline differences in implementation-related determinants between low and high implementers. We then assessed whether permanent characteristics (e.g. gender) and posttest scores were related to the categories of low versus high intenders at posttest. We also assessed whether there was a difference between non-increased intenders and increased intenders in terms of permanent characteristics and in terms of baseline–posttest changes in other determinants. Finally, Wilcoxon signed-rank tests were used to assess differences in determinants between baseline and posttest for the group as a whole. An 0.05 cut-off point for significance was used for all tests.

Results

Response

We received baseline questionnaires from 21 teachers (95.5%) representing all 13 schools, while posttest questionnaires were received from 18 teachers (81.8%) representing 12 schools, and logbooks from 18 teachers (81.8%) representing all 13 schools. A total of 16 teachers (72.7%) of 12 schools were included in all analyses since data from all three sources were available for them.

There were no missing values for implementation data in the logbooks. Most missing values in the questionnaires regarded the subjective norm and social support items at posttest, especially the subjective norm from colleagues (n=4; 22.2%), the coordinator (n=3; 16.7%) and the parents (n=7; 38.9%). All other items had no more than one missing value at baseline and two at posttest. Missing values were not replaced.

Completeness of programme implementation and intention to continue the programme

On average, teachers implemented 10.6 (SD=2.0) of the 14 intended programme elements. The score for completeness of programme implementation was 8.0 (SD=1.9). Eight teachers were classified as low implementers, ten as high implementers. The mean posttest score for intention to continue was 0.47 (SD=1.17; scale -2 to 2). Nine teachers were classified as low intenders, having a neutral (n=5) to negative (n=4) intention, while ten were classified as positive intenders. Eleven teachers were classified as having a decreased (n=5) or

unchanged ($n=6$) intention at posttest compared to baseline, while seven others were classified as having an increased intention at posttest.

Baseline differences between low and high implementers

Baseline self-efficacy scores were lower for low implementers (mean=0.97; SD=0.29) than for high implementers (mean=1.37; SD=0.32) (Table 6.1, column 4). Low implementers perceived a more positive subjective norm from colleagues (mean=2.00; SD=0.00) than high implementers (mean=1.50; SD=0.53).

Posttest differences between low and high intenders

Teachers with a low intention to continue the programme scored lower than high intenders regarding perceived personal benefits (mean=0.50; SD=0.80 versus mean=1.33; SD=0.37) and perceived outcome feasibility (mean=1.00; SD=0.59; -2.92 versus mean=0.39; SD=0.41; $p<0.01$) (Table 6.1, column 5). The low intenders also scored lower on three programme-related determinants, i.e., relative advantage (mean=0.51; SD=0.51 versus mean=1.08; SD=0.46), compatibility (mean=0.67; SD=1.00 versus mean=1.60; SD=0.52) and trialability (mean=1.33; SD=0.50 versus mean=1.80; SD=0.42). They reported a less positive subjective norm from their coordinators (mean=0.29; SD=0.76 versus mean=1.11; SD=0.78) and students (mean=0.33; SD=0.50 versus mean=1.20; SD=0.42) than high intenders.

Differences in baseline–posttest changes between teachers with a non-increased intention and those with an increased intention

Three statistically significant differences were found between teachers with non-increased intentions to continue the programme and those with increased intentions (Table 6.1, column 6). The mean baseline–posttest change in perceived personal benefits was -0.41 (SD=0.84) among teachers with non-increased intentions, versus 0.14 (SD=0.35) among teachers with increased intentions. A mean change of -0.45 (SD=0.69) regarding perceived parents' responsibility for students' dietary intakes was found among non-increased intenders, versus a mean change of 0.14 (SD=0.38) among increased intenders. Teachers with a non-increased intention to continue the programme had implemented the lessons in more classes (mean=3.18; SD=2.40) than the increased intenders (mean=1.43; SD=0.54).

Table 6.1 Mean baseline and posttest scores on determinants, differences between low (LIM; n=7) and high implementers (HIM; n=10), differences between low (LIN, n=8) and high intenders (HIN; n=10), changes between non-increased (NINI, n=11) and increased intenders (II; n=7) and whole-group baseline-posttest changes (% or mean, SD [scale -2 to 2])

	Whole group mean (SD) or % baseline	Whole group mean (SD) posttest	Mann-Whitney U test baseline differences LIM and HIM	Mann-Whitney U test posttest differences LIN and HIN	Mann-Whitney U test change score differences NII and II	Wilcoxon signed rank test posttest- baseline differences whole group
User-related determinants (teacher)						
Self-efficacy	1.19 (0.36)	1.16 (0.36)	-2.204*	-	-	-
Perceived personal benefits	1.11 (0.58)	0.93 (0.73)	-	-2.321*	-2.203*	-
Modelling behaviour	1.50 (0.79)	1.44 (0.71)	-	-	-	-
Perceived outcome importance	1.45 (0.51)	1.20 (0.55)	-	-	-	-2.759**
Perceived outcome feasibility	0.74 (0.61)	0.68 (0.51)	-	-2.915**	-	-
Teachers' beliefs about task responsibilities						
- Students responsible	-0.06 (1.43)	0.33 (0.15)	-	-	-	-
- Parents responsible	1.33 (0.49)	1.11 (0.47)	-	-	-2.012*	-
- Teacher responsible for teaching knowledge	1.44 (0.51)	1.28 (0.58)	-	-	-	-
- Teacher responsible for improving students' dietary intakes	1.11 (0.83)	1.06 (1.00)	-	-	-	-
Gender: female	57.1		-	-	-	
Years of teaching experience	11.4 (9.2)		-	-	-	
Teaching subject						
- Biology	61.9		-	-	-	-
- Care	71.4		-	-	-	-
Number of Krachtvoer classes (range 1-8)	2.32 (1.91)		-	-	-2.142*	
Programme-related determinants						
Relative advantage	0.39 (0.55)	0.80 (0.55)	-	-2.128*	-	-2.420*
Low complexity	0.81 (0.75)	1.11 (0.74)	-	-	-	-
Compatibility	1.70 (0.58)	1.16 (0.90)	-	-2.184*	-	-2.121*
Triability	1.62 (0.59)	1.58 (0.51)	-	-2.002*	-	-
Observability	0.32 (1.16)	0.05 (1.35)	-	-	-	-
Context-related determinants						
Subjective norms from...						
- Colleagues teaching same subject	0.22 (0.73)	0.78 (0.65)	-2.160*	-	-	-2.070*
- Coordinator / manager	1.18 (0.75)	0.64 (0.67)	-	-2.070*	-	-2.310*
- Students	1.64 (0.50)	1.07 (0.92)	-	-3.060**	-	-2.640**
- Parents	1.40 (0.51)	0.80 (0.87)	-	-	-	-

Table 6.1 continued

	Whole group mean (SD) or % baseline	Whole group posttest mean (SD)	Mann-Whitney U test baseline differences LIM and HIM	Mann-Whitney U test posttest differences LIN and HIN	Mann-Whitney U test change score differences NII and II	Wilcoxon signed rank test posttest-baseline differences whole group
Social support from...						
- Colleagues teaching same subject	0.50 (0.62)	0.78 (0.88)	-	-	-	-2.521*
- Coordinator / manager	0.50 (0.52)	0.13 (0.34)	-	-	-	-2.581**
- Students	1.44 (0.63)	0.69 (0.70)	-	-	-	-
- Parents	1.22 (0.81)	0.44 (0.71)	-	-	-	-2.121*
Students' fruit consumption: students eating two servings of fruit a day			-	-	-	-2.919**
<25%	81.0	26.3				
25-50%	14.3	42.1				
50-75%	0	26.3				
75-100%	4.8	5.3				
Students' breakfast consumption: students consuming daily breakfast			-	-	-	-
0-25%	0	5.3				
25-50%	47.6	5.3				
50-75%	42.9	47.4				
75-100%	9.5	42.1				
Students' snack consumption: number of snacks a day	3.39 (0.92)	3.00 (1.09)	-	-	-	-
School size (number of students)	781 (551)		-	-	-	
Schools has oral agreements / a health policy	46.2		-	-	-	
Schools has mainly unhealthy canteen offer	76.2		-	-	-	
Schools has mainly unhealthy vending machine offer	100		-	-	-	
Dissemination strategy-related determinants						
Satisfaction with the support by RPHS		1.37 (0.68)	-	-	-	
During programme implementation						
Involvement in adoption decision			-	-	-	
- Informed or asked for opinion	61.9					
- Involved in decision or decided	38.1					
Krachtvoer discussed at the school						
- Formal meeting with colleagues		68.2	-	-	-	
- Discussed with coordinator		26.3	-	-	-	

* = significant at * p < .05, ** p < .01 = difference not significant

Changes in determinants between baseline and posttest

Compared to baseline, the user-related determinant of ‘outcome importance’ had declined after programme implementation (Table 6.1, column 7). The mean score on the programme-related determinant of ‘relative advantage’ had increased after programme implementation, while the mean compatibility score had decreased. The context-related mean posttest score on the subjective norms from students was significantly higher than at baseline, while the scores on the subjective norms from colleagues and coordinators were lower after programme implementation, as were the mean scores on social support from colleagues, coordinators and parents. Finally, teachers reported that students’ fruit consumption had significantly increased after the programme had been implemented.

Discussion

In the present study we examined determinants associated with the teachers’ completeness of programme implementation and with their intentions to continue the programme, as well as the changes in this intention. We also studied whether determinants had changed after the initial programme implementation.

Numerous determinants have been shown to be related to programme implementation (Durlak & DuPre, 2008; Dusenbury, et al., 2003; Han & Weiss, 2005; Rohrbach, et al., 2006), but our study found only self-efficacy and subjective norms from colleagues to be significantly related to the completeness of programme implementation. This discrepancy may be due to the limited number of participants in our study. Self-efficacy is known to be related to the implementation of several health promotion (HP) programmes in schools (Han & Weiss, 2005; Rohrbach, Graham, & Hansen, 1993; Sy & Glanz, 2008). Although the supportiveness of colleagues at school has also been found to be positively related to programme implementation (Beets, et al., 2008; Durlak & DuPre, 2008; Jourdan, et al., 2010; Rohrbach, et al., 2006), our study indicates that the respondents with the highest scores on the question about subjective norms from colleagues were actually low implementers. A possible explanation is that our adoption strategy, which involved contacting teachers and their coordinators personally in order to recruit them for the programme (Bessems, et al., 2011), may have set a positive subjective norm convincing teachers with lower skills as well. We recommend that the kick-off meeting be adapted so as to particularly target the interactive programme strategies, in

order to increase teachers' self-efficacy (Wiefferink, et al., 2005). Additionally, teachers with low self-efficacy could benefit from receiving feedback (Durlak & DuPre, 2008; Kealey, et al., 2000), for example by means of an online community of programme users.

With regard to the intention to continue the programme, we found that the user-related determinants of 'perceived personal benefits' and 'perceived outcome feasibility' were positively related to the intention to continue. The same relation was found for the programme-related determinants of 'relative advantage', 'compatibility' and 'trialability', and the context-related determinants of 'subjective norms from students' and 'subjective norms from the coordinator at school'. This wide diversity of user-, programme-, and context-related determinants has also been identified by others as important components of sustainable programme implementation (Han & Weiss, 2005; Rogers, 2003; St Pierre & Kaltreider, 2004). It stresses the importance of involving teachers and students in programme development, in order to produce a high quality programme which is appreciated by teachers and students and is feasible and compatible for schools (Bartholomew, et al., 2011; Butler, et al., 2008; Sy & Glanz, 2008). The intention to continue the programme was positively related to the coordinators' subjective norms, but not to their social support. Involving coordinators at the schools in the *Krachtvoer* programme seemed a bit unnecessary, and may be more important if the programme is incorporated in a Health Promoting School approach for the school as a whole (Leurs, 2008). Our study provides some indications that the social environment is important for the intention to continue the programme, but our findings on this relation may be less than reliable due to power issues and the univariate analyses we used. Others have found that support from the school's management is important (Dowda, et al., 2005; Gregory, et al., 2007), as well as dissemination strategy-related characteristics such as ongoing support of change agents (Han & Weiss, 2005), and characteristics in the broader context, including ongoing funding (Gingiss & Boerm, 2009; Han & Weiss, 2005) and district policies mandating prevention (Rohrbach, et al., 1993). These specific elements were not measured and/or not applicable in our study. Further, due to the relative high level of autonomy in determining the content of education of individual schools, the Dutch situation may not be comparable to other countries.

Finally, teachers with non-increased intentions to continue using the programme in the future, perceived less personal benefits, were less inclined to hold parents responsible for students' dietary intakes and had implemented the lessons in more classes than teachers with increased intention scores. The findings relating to personal benefits and the number of classes may be

explained by overoptimistic expectations prior to implementation. Additionally, implementing a new programme in many classes at the same time may have increased the workload for teachers, or may have made teachers lose interest in the programme. The adoption strategy should ensure that teachers develop realistic expectations about the Krachtvoer programme. We have no plausible explanation for the finding of a lower score on the parental responsibility item for non-increased intenders, since no significant changes were found in the student and teacher responsibility items, indicating that this finding could not be attributed to a shift in responsibilities.

Baseline scores for all determinants, except for students' responsibility for their own intakes, were favourable for programme implementation, probably because the study included few unmotivated teachers and teachers in less favourable contexts. Baseline–posttest changes included a decrease in 'perceived outcome importance' and 'programme compatibility', while the mean 'relative advantage' score increased. Teachers generally enjoyed working with the programme (Bessems, et al., submitted), which could partly explain the relative advantage score. Still, the programme may not be fully compatible with their core responsibility in terms of the national educational targets, which focus on acquiring knowledge rather than promoting health (Inspectie van het Onderwijs, 2009; Ministerie van Onderwijs Cultuur en Wetenschap, 2006). This could explain the decreased scores for perceived outcome importance and programme compatibility. As long as this is the case, health promotion will depend on the motivation of individual teachers and the schools' profiling.

As regards context-related determinants, we found decreased subjective norms and support from colleagues and the coordinator at school, and a decreased score on social support from parents. Teachers may have overestimated the social climate prior to implementing the programme, due to the intensive recruitment process, involving other teachers teaching the same subject and the coordinators at school (Bessems, et al., 2011). Most teachers had discussed the programme with colleagues during the implementation phase, but only one out of four teachers had discussed it with their coordinator. Perhaps discussions with coordinators are just not common routine, due to teachers' considerable autonomy, and such discussions may not be required due to the limited school-level consequences of the programme. The increased subjective norm from students might result from the high appreciation of the Krachtvoer programme by the students that we found in another study (Bessems, et al., submitted). A final baseline–posttest change was the perceived increase in students' fruit consumption, indicating that teachers considered the programme to be effective in this aspect.

Some strengths and limitations of our study remain to be addressed. To our knowledge, this is one of the first studies of the determinants and effects of programme implementation of healthy diet promotion in secondary schools. The small number of teachers included implies that our results are explorative; our study probably lacked the power to detect all relevant differences. Some multiple testing effects may also have occurred due to the large number of variables we measured and the use of univariate analyses. In view of the complex nature of implementation and continuation processes, however, testing fewer determinants would have meant an incomplete study. Our group of teachers scored relatively high on completeness of implementation, so our results cannot be generalized to poor programme implementers. The mean score on the intention to continue the programme was a bit disappointing, although few teachers had a negative intention at posttest. Of course, this intention only provides an indication of actual continuation behaviour; since actual continuation took place in the next school year, this was not included in the current study.

The results of our exploratory study do have some preliminary implications for research and practice. Statically significant relations found in this study deserve further exploration by means of multivariate analyses in a larger group of respondents, including the relation with actual programme continuation. Higher levels of completeness of programme implementation could be achieved by an adapted kick-off meeting, feedback and creating an online programme community. With regard to programme continuation, it is important to try and create realistic expectations before implementation and to involve coordinators at the schools if the programme is to be incorporated across the entire school. Programme-related determinants, especially programme compatibility, should be addressed by involving teachers more closely in the continued programme updates.

Chapter 7

General discussion

The first aim of the pilot implementation project reported on in this thesis was to revise the Krachtvoer healthy diet programme and to evaluate this revised programme. The second aim was to develop and evaluate a dissemination strategy, including a study of the determinants associated with teachers' adoption and implementation of the programme, and their intention to continue using it. This chapter summarizes the main findings, discusses some methodological issues, and describes the activities undertaken for the national dissemination campaign. Then, the implications for practice, theory and further research are presented, leading to an overall conclusion.

Main findings of the studies

With regard to the revised Krachtvoer programme, the project has generated findings on its appreciation, implementation, and effects, as well as about the relation between programme appreciation and implementation, and between implementation and effects.

The programme was found to be well appreciated by teachers and students, including the extended target group of students. The practical programme elements in particular (e.g. tasting activities, fruit shake preparation, lunchbox) were well appreciated (chapter two).

Overall, the programme was implemented to a high degree of completeness, though several teachers did not adhere to the intended implementation period. The lessons implemented by the fewest teachers were the last lessons which dealt with making and evaluating a personal action plan. Reasons for omitting certain learning activities were mostly time-related, due to competing activities (such as project weeks) and national holidays (chapter two).

Small but favourable short-term (immediately after the lessons) and longer-term (six months after the lessons) intervention effects on fruit consumption were found, as well as short-term effects on fruit juice consumption. No effects were found on the number of days a week on which breakfast was consumed, which was explained by the relatively favourable baseline consumption pattern. Some worrying effects, such as increases of total fat consumption, were mainly revealed among first-year students at breakfast. With regard to snack consumption, no effects were found on snacking frequency, but significantly more students in the experimental condition reported at the first and/or second posttest that they now more often consumed healthier snacks (chapter three).

Some moderately strong relationships were found between teacher appreciation and completeness of implementation scores, indicating that teacher appreciation may be an important determinant of implementation

(chapter two). Completeness of programme implementation was positively related to short-term changes in fruit consumption. Specifically, completeness of implementation of tasting activities and the preparation of a fruit shake and a practical lesson on advertisements proved to be associated with an increase in fruit consumption in the short- and longer-term, indicating the relative importance of these practical programme elements. No such relations were found for breakfast consumption (chapter four; see also paragraph on measurement issues).

With regard to the dissemination strategy the project generated findings on adherence to the adoption strategy, and effects of the strategy on adoption rates, implementation levels and intention to continue using the programme. The health promotion (HP) professionals adhered closely to the intended adoption strategy (chapter five). The steps that were less fully adhered to were not considered to be important for the adoption process by all professionals (e.g. writing a project plan) or were affected by major barriers (contacting teachers was difficult since they were difficult to teach between the lessons). Although laborious, the person-to-person approach was considered to be very important in the recruitment process. The handbook describing the adoption strategy, the recruitment materials and the supporting materials provided were well appreciated and regularly used by the HP professionals. On average they spend 18 hours per school on the adoption process. It is questionable whether it is feasible to target a large number of schools in a real-life setting.

The dissemination strategy resulted in an adoption rate of 53%, which is considered considerable (chapter five). Considerable levels of completeness of programme implementation were revealed, with 87% of the fixed lessons and 65% of optional activities implemented (chapter two). Immediately after programme implementation, 53% of the teachers had a positive intention to continue the programme the next school year (chapter six).

Finally, the studies into determinants of programme dissemination generated findings that gave indications for how to improve programme dissemination. Most determinants of programme adoption or rejection were programme-related, school-related and, in the case of the adopters, also teacher-related. Adopters perceived the programme to offer added value, they appreciated the possibility to combine the programme with existing lessons, and found the materials attractive, while rejecters found that *Krachtvoer* had no added value, and felt that the programme required too many lessons. School-related reasons mentioned by adopters were the flexibility of their school curriculum, the support of colleagues, and the current interest in the topic of nutrition at the school (both high and low interest being mentioned as reasons), while almost all rejecters mentioned the use of another programme and the

inflexibility of the school curriculum as a reason for programme rejection. Lastly, adopters also mentioned teacher-related reasons, including the fact that they liked to try something new, enjoyed teaching the topic of nutrition, and regularly used external materials (chapter five).

Completeness of programme implementation proved positively related to self-efficacy of teachers and negatively related to subjective norms from colleagues (chapter six). Determinants of the intention to continue the programme were perceived personal benefits, perceived outcome importance, programme compatibility, relative advantage, and trialability (all positively related to the intention to continue the programme). Unfavourable changes in intention between baseline and posttest were related to lower perceived personal benefits, lower parental responsibility for students' dietary intakes, and a higher number of classes in which the teacher had implemented the programme (chapter six).

Methodological considerations

The studies described in this dissertation had some methodological limitations, which should be considered when interpreting the results. This section describes the most important considerations, which concern issues of design, sampling and measurement.

Design issues

A randomized controlled trial (RCT) is regarded as the 'gold standard' for studying programme effects because of its high levels of internal validity. However, our RCT did not allow randomization of students, since students were clustered in classes and influenced each other in those classes. Cluster randomization at school level was the best solution to limit the effects of contamination. As a result, we corrected for differences between students using multilevel analyses.

Unfortunately, the randomization procedure was not entirely successful. Of the 25 schools included in our study, three schools were assigned to the control condition at their own request, due to issues unrelated to health or students' food intakes. The group as a whole was representative of the relevant educational subtracks in the Netherlands (i.e. around two-third of the students in our sample attended the third and fourth prevocational subtracks and one-third attended the second prevocational subtrack, which corresponds to the figures for the Netherlands as a whole (Centraal Bureau voor de Statistiek, 2010). However more students of the two highest prevocational subtracks than students of the lower subtrack, and more second-year students than first-year

students were in the experimental condition. We dealt with this by correcting for all background characteristics in all analyses. Lastly, one experimental school dropped out of the study, since it had not implemented the Krachtvoer programme due to logistic problems at the school. This school was not included in the analysis.

Another design issue is that the follow-up assessment was limited to a period of six months after the end of the programme implementation. Although this was an improvement compared to the first RCT (Martens, et al., 2008), a one- or two-year follow-up would have provided insight in whether effects persist over a longer time period. A longer follow-up period was incompatible with the four-year term of the project and would have been faced with practical issues, including that students attending the first year (in which multiple subtracks are combined in one class), would have to be tracked into different classes (fitting their academic abilities) in the following year. It was unclear whether teachers who agreed to participate in the Krachtvoer project would teach the same students the next year, so other teachers would need to be involved in an assessment of long-term effects, possibly leading to large drop out rates.

The most important design-related issue of the dissemination studies was that there was no control condition applying another adoption and implementation strategy, or using other intermediaries than the HP professionals from regional public health services (RPHSs). The results therefore do not allow us to conclude that our strategy produces more favourable results than other possible strategies. However other studies do indicate that ongoing contact with a change agent is more successful than using only mailings or media attention without additional implementation support (Buller, et al., 2005; Durlak & DuPre, 2008; McBride, et al., 2007). Another issue is that the 53% adoption rate may not be generalizable to a real-life situation. On the one hand, schools were recruited for Krachtvoer and for participation in the RCT, which may have led to lower adoption rates. On the other hand, the adoption rate could be an overestimation of a real-life situation since the HP professionals were more dedicated to meeting prior targets, they were able to spend sufficient time on recruiting schools, and they recruited schools for a programme which was provided free of charge (in contrast to the national dissemination of the programme). Despite these concerns, our findings indicate that the efficacy of such a person-to-person approach is promising.

Sampling issues

We included enough students in the studies evaluating the Krachtvoer programme, but the number of teachers in the studies on programme

dissemination was limited. This was difficult to prevent since only one or two teachers were teaching the Krachtvoer lessons at most schools.

In the implementation study, a large number of non-parametric univariate analyses were conducted in order to explore determinants of teachers' programme implementation. This may have caused multiple testing issues, and the results should thus be considered exploratory.

Other sampling issues relate to the selectiveness of our sample. Only RPHSs with motivated HP professionals, who expected that schools in their regions were likely to adopt Krachtvoer, may have been willing to participate in the project. By using diverse inclusion criteria for RPHSs, we tried to accomplish diversity regarding catchment areas, the implementation of other health promotion projects and the whole school approach. However, our results can not be generalized to RPHSs and schools in the four largest cities of the Netherlands (i.e. Amsterdam, Den Haag, Rotterdam and Utrecht, known as G4). The composition of the population in these cities is somewhat different from that of the rest of the Netherlands, as more people of non-Western ethnicity and more people with low incomes live in the G4 (Centraal Bureau voor de Statistiek & Sociaal Cultureel Planbureau, 2008).

The Krachtvoer programme targeted students attending the three highest (of four) subtracks of prevocational education. A lower educational track is known to be an important determinant of health problems later in life (Centraal Bureau voor de Statistiek, 2008) and is also an aspect of socio-economic position (SEP). The measure of SEP we used, which was based on postal code, showed that the mean SEP of our target group was comparable to the national level.

This may be a measurement issue, since postal code as an indicator of SEP lacks sensitivity. However, it is also likely that it reflects the fact that disadvantaged students are mostly found in the two lowest educational subtracks of prevocational schools and in special education, while our sample was limited to students attending the three highest subtracks.

Measurement issues

A strong point of our RCT was that we assessed students' dietary intakes by means of a questionnaire including both food frequency items and recall items (Thompson & Subar, 2008). We included fruit, fruit juice, breakfast and snack items derived from valid food frequency questionnaires (van Assema, et al., 2001; van Assema, et al., 2002) and recall items on fruit, breakfast and snack consumption used in the RCT of the first PhD project (Martens, et al., 2008). A drawback is that both measures are based on self-reports and, like other self-reported measures, may have been affected by reporting errors. Self-reported dietary assessments require good estimation skills (Burrows, Martin, & Collins,

2010; Livingstone & Robson, 2000; Livingstone, Robson, & Wallace, 2004), lack sensitivity and are liable to social desirability issues, especially among children and adolescents (Livingstone & Robson, 2000; Livingstone, et al., 2004). Alternatives to self-reports, such as observations and the use of biomarkers, are less suitable for large populations, due to high costs and low response rates (van Assema, et al., 2002). An additional disadvantage of biomarkers is that they reflect not only dietary intake but also a number of physiological processes (Pollard, et al., 2003). Self-reports were thus considered the most suitable for the current project.

Lack of sensitivity may have been especially problematic with regard to the breakfast recall item, due to the open-ended nature of the question. Some students filled in dietary items such as 'milk' without specification (e.g. skimmed milk), so we had to impute these vague answers based on frequently consumed types of milk products, derived from previous food consumption surveys (TNO, 2004). A specific issue of the snack category items was that students in the experimental condition learned to distinguish more favourable types of snacks from less favourable products during the lessons which may have led to social desirable answers, while students in the control condition may not have been provided with this information. The high non-response rates of up to 21% on our snack category items may imply that the question was too difficult to answer at baseline for all students, and at both posttests for students in control schools since they could not generalize comparable products to the proposed categories.

The dissemination studies were also affected by some measurement problems derived from problems at a higher level. Although around a quarter of (school-based) intervention trials in public health report aspects of fidelity of implementation (Borrelli, et al., 2005; Gresham, Gansle, Noell, & Cohen, 1993), no standard measures are available, so researchers may base their measures on common sense. This may also explain the diversity of concepts used in dissemination research. Dusenbury and colleagues (2003) have therefore called for universally agreed definitions of fidelity of implementation and the development of reliable measures. On the other hand, measures in dissemination research need to be adapted to specific projects in a specific context (e.g. countries, schools) and are therefore difficult to standardize. The measures applied in the *Krachtvoer* studies were derived from instruments and findings from other research, in Dutch settings. The quality of these measures, however, has not yet been determined.

The generalizability of our results may be limited due to measurement issues. First, we measured the intention to continue the programme in stead of actual continuation. Schools need to finance the *Krachtvoer* programme

themselves during the national dissemination campaign (see also the section on national dissemination), whereas the materials came free of charge in the pilot implementation project. Second, teachers may have been more motivated to implement the programme as a whole since they were participating in a research study, while completeness of implementation would have been lower if teachers had implemented the programme without an accompanying study.

We further assume that teachers were induced to teach the programme more completely by the fact that they had to record their activities and lesson observations in a logbook, which previous research has found to be associated with higher levels of fidelity of programme implementation (Durlak & DuPre, 2008; Dusenbury, et al., 2003).

The last issue relates to the sensitivity of our measure of completeness of implementation. Teachers filled in only one logbook, whereas lessons were taught in up to eight classes, so that differences between classes were not recorded. It would also have been more precise to use data on students' absence from class to examine the relationship between completeness of programme implementation and the behavioural effects on students' dietary intakes. There are some indications that observations are more sensitive and valid than self-reports by teachers (Resnicow, et al., 1998). However, separate logbooks for each class as well as using absence data from students would have increased the burden for the teachers and possibly reduced response rates, as it would have engendered ethical issues.

National dissemination of Krachtvoer

To relate the findings of the project to the ongoing national dissemination process for Krachtvoer, this section describes the activities undertaken for the national dissemination campaign during and immediately after the pilot implementation project.

National dissemination of the Krachtvoer programme was foreseen right from the development of the first version. The grant proposals for both PhD projects were joint initiatives of the participating research institutes and national health promotion organizations. As explained in the first chapter of this thesis, linkage groups with representatives with relevant stakeholders were set up for both PhD projects. All those involved worked towards a national programme dissemination process to be coordinated by one of the health promotion institutes, and to be implemented immediately after completion of the RCT that was done as part of the current PhD project. During the process it became clear that the National Institute for Health Promotion and Disease

Prevention (NIGZ) was willing to take on the coordinating role, in collaboration with the Netherlands Nutrition Centre and Maastricht University.

Due to changes in the way national health promotion institutions are funded, NIGZ was no longer funded by grants from the Ministry of Health as it had been earlier on, but became dependent on commissions from third parties. The Nutrition Centre was also faced with budget cuts for the implementation of health promotion programmes. At the same time, one of the other collaborating organizations, the Dutch Heart Foundation, changed its priorities from nutrition to obesity prevention, so a key role in the implementation of the *Krachtvoer* programme no longer fitted its policy. This meant that none of the institutes was in a position to take on the coordinating role without additional funding. A lobbying campaign was started by Maastricht University and NIGZ, which wrote a letter to the Ministry of Health explaining the problem that there was now no national institute that was responsible for, and received funding for, the long-term national dissemination of effective health promotion programmes in the field. At the same time, the Dutch Organization for Health Research and Development (ZonMW) and the Netherlands Organization for Public Health and the Environment (RIVM) were contacted through various personal channels to address this issue, but no long-term solution was found.

To solve the issue in the short term, NIGZ tried to obtain funding from several industrial organizations involved in healthcare (e.g. pharmaceutical companies) or dietary products (e.g. supermarket chains, food companies), but their efforts were unsuccessful.

A temporary construction was then set up, in which schools would pay for the programme materials, while the RPHSs would pay for the training courses for HP professionals organized by NIGZ, as well as for the time spent by NIGZ on national coordination tasks. This was not an ideal solution due to high costs of the full colour programme materials. In order to help set up the national programme dissemination project, Maastricht University financially guaranteed the printing of programme materials for 2000 pre-vocational school students, which would be later refunded from the sales of materials to schools over the next years.

In October 2009, NIGZ, the Netherlands Nutrition Centre and Maastricht University signed an agreement in which the three parties took joint responsibility for the national dissemination campaign for *Krachtvoer*, agreeing to update the programme in 2013. The three parties advised each other on all project- and research-related tasks. The main tasks for NIGZ were general project coordination (including fund-raising and working out the implementation and communication plan), recruiting HP professionals for the training course, adapting and providing the course developed during the pilot

implementation project to HP professionals and distributing the Krachtvoer programme materials to schools. The main tasks of Maastricht University were organizing the collaborative agreement between the three parties, introducing minor adaptations in order to prepare the programme and the dissemination handbook for national dissemination, organizing the printing of programme materials for 2000 students, submitting Krachtvoer for a quality assessment to the Dutch Centre for Healthy Living, revising the programme materials in 2013, and setting up further research for the dissemination of the Krachtvoer programme. The collaborative agreement could be terminated if the project failed (e.g. due to lack of interest in the training course or insufficient sales of programme materials).

The three main activities undertaken afterwards were (1) registering the programme in a national quality assessment database, (2) recruiting HP professionals to participate in the Krachtvoer dissemination training course and (3) finding short-term funding for national programme coordination and the programme materials. These aspects will be discussed in more detail.

Since 2009, the RIVM and the Netherlands Youth Institute (NJI) have implemented a quality assessment system for health promotion interventions (Brug, et al., 2010; www.loketgezondleven.nl). Health promotion programmes can be awarded one of five quality levels, viz. 'well described', 'theoretically sound', 'probably effective', 'established effectiveness', and 'established cost-effectiveness'. The aim of the system is to provide professionals and policy makers with information on programme quality and effectiveness, so as to indirectly promote the use of high-quality interventions in practice. Submitting the Krachtvoer programme to this assessment system was not possible until its national coordination by NIGZ was formally agreed in October 2009, since 'having an owner for national dissemination' was a prerequisite for submitting the programme to the quality assessment system. In the spring of 2010, Krachtvoer was submitted for quality assessment and registered as a theoretically sound programme in the national intervention database (Bessems, 2010). The programme's quality was assessed of 'theoretically sound' and not 'probably effective' or 'established effectiveness', since an article presenting the results of the second RCT, with a follow-up of 6 months (which was the minimum prerequisite), was not yet accepted for publication in a peer reviewed scientific journal. The short-term results of the first RCT (Martens, et al., 2008) did not meet the criteria of the quality assessment system. The potential benefits of the label 'probably effective' or 'proven effectiveness' for obtaining funding and the dissemination process of the programme were thus not yet realized.

The training of the HP professionals encountered some difficulties. In 2010, NIGZ offered the training course to HP professionals twice, but the course had

to be cancelled both times due to insufficient applications. Although HP professionals were interested in the *Krachtvoer* programme, they mentioned the high course fee, and the fact that the course only aimed at the dissemination of one specific programme, as the main reasons for not applying. In the summer of 2010 additional funding was obtained from ZonMW (de Ruiter, 2010). This funding allowed the training course to be adjusted, and HP professionals from RPHSs and other intermediary organizations (i.e. dietitians, educational assistance agencies) to be trained free of charge. Additionally, NIGZ was able to organize an additional *Krachtvoer* meeting for students from the Bachelor's programme on Health Care and Wellbeing, so as to address future teachers.

Lastly, the *Krachtvoer* programme materials could now be offered for free to 50 classes of newly adopting schools (with a maximum of 2 classes per school).

In March and April 2011, ten new HP professionals attended the revised training course on programme dissemination. The revised course is shorter and does not focus only on the dissemination of *Krachtvoer*, but instead addresses four Dutch nutrition education programmes for prevocational schools. The training course was provided by NIGZ in collaboration with Maastricht University, the Nutrition Centre (coordinator of the programmes entitled 'Know what you eat' and 'Healthy School Canteen') and the VU Medical Centre Amsterdam (coordinator of the obesity prevention programme 'DO-iT'). The meeting for teachers was held in the spring of 2011.

In addition to these new initiatives to promote the dissemination of *Krachtvoer*, dissemination efforts by HP professionals from the five RPHSs, and programme implementation by teachers from the 25 schools continued to some extent in the following years (van den Bogaert, 2011). The five RPHSs which had participated in the pilot implementation project kept supporting experimental and control schools to some extent at their request in the year following the conclusion of the RCT. One of the RPHSs was able to get funding from the local authorities, allowing schools in their region to order the programme materials free of charge. Three other RPHSs do list *Krachtvoer* in their overviews of health promotion materials for schools in the region, but no longer actively inform schools about the programme. One RPHS stopped offering the programme, since its policy was to focus only on health promotion in primary schools. Overall, no permanent funding for the *Krachtvoer* programme has as yet been found.

Implications for practice

The findings from the studies presented in this thesis have several implications for practice, which relate to Krachtvoer, the dissemination strategy, and the socio-political context.

Programme-related implications

We recommend nationwide dissemination of the Krachtvoer programme, but the breakfast lessons should be deleted from future versions of the programme. In order to increase the effects of the programme, it should be further revised and preferably implemented as part of a whole-school approach. Programme dissemination should be further improved in a real-life setting.

Three recommendations are proposed in order to increase programme effects. First, the teachers' manual should integrate a short overview of the findings of the studies presented in this thesis. It should be targeted at convincing teachers to implement the programme fully, and stress the importance of practical activities (e.g. taste testing). It should further discuss the complexity of implementing the programme in many classes simultaneously, in order to ensure that teachers have realistic prior expectations about the programme. Second, due to the lacking effects on breakfast consumption, these lessons should be removed from a new version of the programme. It is questionable whether breakfast consumption is a major public health issue among Dutch students in this age group (Raaijmakers, et al., 2009). We recommend re-examining the epidemiological data on dietary intakes among this target group, to identify the most problematic modifiable health-related dietary behaviours, and replacing the breakfast topic by a more problematic one (Bartholomew, et al., 2011; Green & Kreuter, 2005). It is not recommended to include lessons on physical activity, since this will increase implementation complexity given the fact that physical activity is a separate subject in secondary schools, which is implemented by other teachers. Last, it would be best to optimize the programme's effects on dietary behaviours, by incorporating Krachtvoer into a more comprehensive whole-school approach, which targets the environment as well (Boonen, et al., 2009; Contento, 2007; Hoelscher, et al., 2002; Laurence, et al., 2007). The Health Promoting School (or an adapted version of it) is a Dutch example of such an approach, which is supported by 58% of the RPHSs (Boot, et al., 2011). However, the implementation of this method is fraught with issues of limited time and lack of support by RPHSs and schools (Boot, et al., 2011) and may depend on further socio-political changes.

To improve the dissemination of Krachtvoer in real-life more extensive changes are recommended for the 2013 revision process. The time issues mentioned by implementing teachers could be alleviated by allowing teachers to choose a specific dietary topic, but still proceed through the three phases of self-management (Boekaerts, et al., 2000).

Just as in the evaluation of the first version of the programme, the final lessons had the lowest scores for appreciation and completeness of implementation. We therefore suggest transforming Krachtvoer into a modular programme, from which teachers can choose topics to teach at several moments during the school year. In addition, it is worth exploring if programme compatibility with teachers' needs could be increased, by addressing knowledge aspects more specifically in the context of essential practical activities (e.g. by combining tasting activities with information on nutrients). A subsequent step would be to incorporate the essential programme elements of Krachtvoer in one of the most commonly used textbooks on biology and care offered by educational publishers. The fact that these textbooks primarily focus on increasing students' knowledge and do not address only nutrition but other topics as well means that it may be problematic to include the whole programme. Including essential programme elements in commonly used biology or care textbooks may allow more teachers to be reached than any other dissemination strategy based on persuasive communication could accomplish. The full programme should remain available for teachers who are motivated to implement more lessons.

Implications relating to the dissemination strategy

Programme dissemination could be improved by further adjusting the proposed person-to-person approach and combining it with other dissemination strategies, which should again be developed in close collaboration with HP professionals and teachers, using insights into determinants and strategies of programme dissemination from the recent literature. In the current socio-political context, efforts should be mainly targeted at highly motivated teachers. Further research should explore whether students can be involved as change agents.

The person-to-person approach should be combined with other dissemination strategies, such as media attention and the use of networks. This is common in Dutch RPHSs (Bessems, 2007) and combined dissemination strategies have also been shown to be successful in the USA (Hoelscher, et al., 2001).

More specific recommendations on the current dissemination strategy, relate to adjustments to the kick-off meeting for teachers, to stimulate greater

completeness of programme implementation. Teacher with lower self-efficacy expectations could benefit more from the kick-off meeting if principles of feedback (Durlak & DuPre, 2008; Kealey, et al., 2000) and interactive programme strategies (e.g. motivating students to develop a personal action plan) are focused on. Also, the kick-off meeting should discuss the study results related to completeness of implementation and programme effects, as suggested earlier for the teachers' manual.

Unfortunately, there seems to be a gap between what works in an ideal situation and what is possible in real-life. Although the person-to-person approach we used was considered essential by the HP professionals, it was also considered laborious and time-consuming. The dissemination strategy was only marginally implemented by the RPHSs after the pilot implementation project. It is therefore questionable if it is feasible for RPHSs to target large numbers of schools in a real-life setting, so alternatives should be considered. In the current socio-political context dissemination efforts should primarily aim for high-quality implementation and continuation of the *Krachtvoer* programme by motivated teachers, instead of investing great efforts in trying to convince schools where circumstances for health promotion programme adoption are far from optimal (e.g. those with low curriculum flexibility and high resistance towards external programmes). Also, network learning through online communities for teachers (e.g. www.kennisnet.nl, www.leraar24.nl) is becoming increasingly important in the Netherlands (Korenhof, Schreurs, Meijs, & de Laat, 2010). These communities may be a good channel to inform motivated teachers, and provide opportunities for sharing information on health promotion programmes, offering instruction movies on programme implementation, and sharing experiences among teachers. It is further worth exploring whether a national coordinating body like NIGZ can serve as a change agent for programme dissemination. Students from Bachelor's Health Care and Wellbeing, could be asked, as part of an internship, to organize kick-off meetings for schools in regions where the RPHS does not actively support *Krachtvoer*.

Contextual implications

Although factors relating to the socio-political context were not revealed as the most important ones in the studies underlying this thesis, such factors are essential to achieve national programme dissemination. Further changes in the socio-political context were needed to improve health promotion efforts in schools. These changes include efforts by health promotion experts to link health issues more closely to educational targets, incorporating health issues in

educational targets, and achieving systematic and long-term ownership of and funding for effective health promotion programmes.

As outlined in the introduction to this thesis, Dutch schools have considerable autonomy in designing their curriculum. Teachers are free to choose textbooks for their own subject, and some teachers choose to develop their own teaching materials for some of the topics. Health promotion is not a core business of schools, which mainly focus on increasing knowledge, while health promotion focuses on more general life skills. The dissemination of health promotion initiatives depends on the ability to convince individual schools of its benefits. Public health experts should also try to relate their health promotion efforts more closely to the direct primary purpose of schools, i.e. education. Health promotion should be seen as a means and not as an outcome. An interesting example from Germany is the *Anschub* project (www.anschub.de), supported by federal states. In this project, health is seen and promoted as one of the aspects of a 'good and healthy school'. Health is regarded as input to improve educational quality, and health promotion tries to contribute to educational quality (Paulus, 2009). This may be especially difficult for the topic of nutrition, however, since the consequences of unhealthy nutrition are not directly related to learning outcomes. Only breakfast habits have been shown to be related to better cognitive functioning and school performance (Rampersaud, et al., 2005), but Krachtvoer was not successful in changing breakfast consumption. Other health promotion topics, such as the prevention of bullying or drug abuse, may be more likely to interfere with class management, and have short-term consequences, with which teachers are directly confronted. Ideally, health topics should be specifically incorporated in the national educational targets, making health a fixed teaching topic. In Scotland, the government has made it a formal target for each school to become a 'Health Promoting School', and the school inspectorate focuses not only on curriculum quality, but also on aspects of schools that influence health, such as the quality of food in school canteens (Young & Lee, 2009).

We were confronted with structural barriers at national and regional levels not only in schools, but also in the field of public health. There is no systematic national policy on the nationwide dissemination of effective health promotion programmes. As a result, there is no implementing institute, nor are the national health promotion organizations responsible for the dissemination of effective programmes. The Dutch Ministry of Health has suggested that health promotion initiatives should be arranged at regional level and funded by municipal authorities. However, national coordination tasks are unlikely to be funded at regional level. We found ad-hoc funding, but this was no permanent solution. And at regional level, only one of the five RPHSs which participated

in our pilot implementation project was able to raise additional temporary funding from the municipal authorities for the Krachtvoer programme materials. In all other regions, Krachtvoer is currently financed by the schools. Raising funds to support HP professionals in implementing a person-to-person approach would seem to be even more difficult. Although there is a continuing need to develop successful health promotion initiatives, there may be an even more urgent need to stimulate the dissemination of existing successful initiatives. This issue has also been recognized by the Dutch Ministry of Health in its recent health policy plan (Ministerie van Volksgezondheid Welzijn en Sport, 2011). However, as long as no funding is provided to address this problem effectively, promising health promotion initiatives and dissemination strategies will continue to encounter dissemination problems.

Theoretical considerations and implications

The main framework used for the dissemination studies of the Krachtvoer programme was the diffusion of innovation framework developed by Paulussen and colleagues (Paulussen, et al., 2007). Although the goal of the studies presented in this thesis was not to focus specifically on the relations between the individual determinants described in the model, some recommendations are briefly addressed below.

The model was used to examine the possible determinants which could influence the dissemination process and which should be addressed in our dissemination strategy. For example, we provided the HP professionals with information on national education targets (socio-political context) and on the structure of schools (school-related factor) to help them relate to the daily practice of schools. The model further revealed the complexity of dissemination processes, covering many determinants related to programme adoption, implementation and continuation. In the adoption study, reasons for adopting or rejecting the programme given by teachers in open-ended questions were later linked to the model, while the implementation and continuation study used a questionnaire incorporating determinants at several levels.

An issue of the model is the ambiguity of allocating determinants to the various categories of main characteristics; e.g. the subjective norm of a school manager as perceived by a teacher could be defined as a teacher-related characteristic as well as a school-related characteristic. A related issue is that the specific determinants within these categories also need further operationalization. This operationalization of general characteristics requires the use of other specific theories. For example, the study reported on in chapter six included programme-related attributes of Rogers' Diffusion of Innovation

Theory (Rogers, 2003) for the operationalization of programme-related determinants. Lastly, the complexity of the Krachtvoer implementation pilot project, in which an intermediary organization was involved in supporting the programme dissemination effort, was not fully covered by the model. We therefore incorporated the HP professionals and RPHS as an aspect of the dissemination strategy in the adoption study (chapter five). An alternative approach would be to define the HP professional as another user. In that case the innovation would not be the Krachtvoer programme, the dissemination strategy. The HP professionals are in turn influenced by their own RPHSs, the dissemination strategy (innovation), and a comparable socio-political context. The dissemination strategy would be the support of the national coordinator to help the HP professional adhere to the dissemination strategy.

Implications for further research

Finally, the findings and methodological considerations have several implications for further research related to Krachtvoer and its dissemination strategy, research into health promotion interventions and dissemination in general, and for coping with some methodological problems encountered in this type of research.

Krachtvoer research agenda

In the short term, we recommend further studies into the effects of the Krachtvoer intervention on the determinants of students' dietary intakes which were specifically addressed in the programme. Changes in determinants of breakfast intake should particularly be studied, to verify our recommendation that the breakfast-related lessons should be eliminated from the programme. The studies discussed in this thesis were limited to the relation between implementation and changes in dietary intakes, whereas it would be interesting to examine the relation between appreciation and programme effects, as others have shown that appreciation is an important mediator for dietary change (Tak, et al., 2009; Wind, et al., 2008).

As indicated earlier, there remains a need to continually update promising health promotion programmes. In the long term this also implies evaluating revised programmes (or programme elements). It would also be interesting to study the effects of a broader, whole-school approach in which Krachtvoer is one of the key elements. An effect evaluation of such an approach should cover both the short and longer term (i.e. one or two years), in a real-life situation. Monitoring of aspects of implementation (e.g. numbers of teaching hours spent on the topic of nutrition, implementation of practical activities) should be

included in both control and experimental schools, to identify key elements of such a whole-school approach. To improve the generalizability of the findings, schools in one of the G4 cities should also be included in such studies.

With regard to programme dissemination, we strongly recommend conducting a real-life study into the national dissemination of *Krachtvoer*, to reduce problems of generalizability and sample size. This should provide ample opportunities to examine determinants and successful strategies of programme dissemination in larger samples in the real world, for example by incorporating open-ended questions on reasons for ordering the materials through the NIGZ online ordering system, or by conducting short telephone interviews about reasons for programme continuation. A further step would be to incorporate cost-effectiveness analyses of dissemination strategies. The dissemination studies should preferably be conducted without an accompanying RCT to increase generalizability.

General research agenda

Given the limited number of studies evaluating healthy diet promotion programmes in secondary schools, it is worth further investigating how we can effectively promote healthy diets in this setting. Since we were unable to reach the lowest-SEP students, as we concentrated on the three highest tracks of prevocational education, it is worth developing and investigating the effects of interventions for the lowest subtrack of prevocational education, as well as for schools of the lowest secondary school track special education.

With regard to dissemination, there has been little research into the dissemination of nutrition education programmes. Within mainstream dissemination research, many studies have focused on determinants of implementation (Durlak & DuPre, 2008; Dusenbury, et al., 2003). As regards dissemination strategies, we found few examples of high-quality evaluations of adoption strategies for schools, while much more research has been dedicated to evaluating implementation strategies, such as training, assistance and feedback (Dusenbury, et al., 2003; Han & Weiss, 2005). In addition, the number of studies reporting on the evaluation of continuation strategies is also limited, which may contribute to the fact that few HP professionals are experienced in supporting the maintenance of successful health promotion initiatives in practice. We strongly recommend further research in this area, in real-life situations without an accompanying RCT.

Addressing methodological issues

The issues of the sensitivity of our measures might be addressed by means of online questionnaires with prestructured dietary recall items. This may be particularly useful since it would allow a large variety of foods to be covered. The assessment could be tailored so as to skip detailed information on food categories not consumed by an individual respondent, while focusing in detail on food items the respondent does consume. This would allow detailed questioning with a limited questionnaire length. Structured dietary recalls may also be a better method to measure snack consumption. We therefore recommend a validation study on the snack category items.

The field of dissemination research urgently needs clear main concepts and operationalizations of key constructs, but these will always be tailored to specific interventions (Proctor, et al., 2011). Individual authors should clearly report how they have operationalized the aspects of fidelity of implementation they have measured, as well as the methods they used to measure such aspects, to allow comparisons between studies. For the time being, structured observations by trained observers seem the best method to measure aspects of implementation fidelity (Dusenbury, Brannigan, Hansen, Walsh, & Falco, 2005; Resnicow, et al., 1998). Although these methods are time-consuming, they have been shown to be valuable (Dusenbury, et al., 2005; Johnson, et al., 2010) and we therefore recommend them for future research.

Overall conclusion

The pilot implementation project has resulted in an improved version of the Krachtvoer programme, which is currently disseminated at national level. The current evaluation of the programme has yielded new recommendations, and represents a step further in intervention research. It is concluded that Krachtvoer is a promising tool to change fruit and snack consumption among students in prevocational schools, which should preferably be implemented as a component of a more comprehensive whole-school approach. Promising health promotion programmes such as Krachtvoer, should be continually adapted to changing socio-political contexts (e.g. national dietary guidelines, changes in the educational system) and changing needs of students and teachers.

What makes the research underlying this thesis unique is that it was one of the first studying determinants and strategies of dissemination, as well as the subject of the dissemination strategy (i.e. the Krachtvoer programme). The degrees of programme adoption, implementation and continuation that were

achieved are acceptable to considerable, but dissemination by RPHSs in real-life settings may not be feasible. Dissemination strategies should be based on literature studies of theory-based methods for programme dissemination, targeting important determinants and successful strategies which evaluation studies have shown to be promising. Input from HP professionals as well as the teaching profession is essential in order to make a dissemination strategy that fits the needs of the field and the socio-political context. Further progress in the dissemination of health promotion interventions will require more high-quality studies on this subject, especially in non-experimental settings.

Appendix A Definitions

Appendix A definitions

derived from Rogers, 2003 and Dusenbury et al, 2003

Diffusion. The unplanned spread of an innovation.

Dissemination. The planned overall innovation decision process of innovation adoption, implementation and continuation of an innovation.

Adoption. The phase in which potential users decide to make use of an innovation. In the case of Krachtvoer this relates to the decision by teachers and school coordinators to make use of the Krachtvoer programme.

Implementation. The phase in which people actually use the innovation. In the case of Krachtvoer this involves teachers teaching the Krachtvoer lessons in their classes.

Continuation. The phase in which the innovation is continued over time after the initial dissemination project has ended. In the case of Krachtvoer, this relates to teachers continuing to use the programme in the next school year(s).

Dissemination strategy. A systematic strategy for health promotion professionals from regional public health services. The dissemination handbook is described in a handbook. The strategy is divided in three sub strategies targeting the three critical phases of teachers' innovation decision making.

- a. *Adoption strategy.* This strategy targets that a teacher or school coordinator decide to implement the Krachtvoer programme.
- b. *Implementation strategy.* This strategy targets to achieve high levels of fidelity of programme implementation by the teacher.
- c. *Continuation strategy.* This strategy targets to achieve that the Krachtvoer programme is continually used the next school year.

Fidelity of implementation. The extent to which a programme is delivered as planned. Fidelity includes five aspects:

- a. *Adherence.* Implementing a programme as intended by its developers.
- b. *Completeness or dosage.* The proportion of elements implemented in relation to the proportion of elements which should be implemented. In the case of Krachtvoer this is further divided in:
 - *The completeness of element implementation.* The number of activities implemented in a programme element (fixed lesson or optional activity).
 - *Completeness of programme implementation.* The number of activities carried out in all lessons and the optional activities implemented.
- c. *Quality of programme delivery.* Teaching a programme in such a way as to make it appealing to students.
- a. *Participant responsiveness.* The degree to which participants engage in the programme
- b. *Programme differentiation.* The degree to which elements would distinguish one type of programme from another

Pilot implementation project. The current PhD project on Krachtvoer described in this thesis, in which the Krachtvoer programme was revised and evaluated, and a dissemination strategy was developed, implemented and evaluated.

References

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Ammerman, A. S., Lindquist, C. H., Lohr, K. N., & Hersey, J. (2002). The efficacy of behavioral interventions to modify dietary fat and fruit and vegetable intake: a review of the evidence. *Preventive Medicine*, 35(1), 25-41.
- Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernandez, M. E. (2011). *Planning health promotion programs. An intervention mapping approach*. (3 ed.). San Francisco: Jossey-Bass.
- Beets, M. W., Flay, B. R., Vuchinich, S., Acock, A. C., Li, K. K., & Allred, C. (2008). School climate and teachers' beliefs and attitudes associated with implementation of the positive action program: a diffusion of innovations model. *Prevention Science*, 9(4), 264-275.
- Bessemers, K. (2007). *Resultaten van een kwalitatieve studie naar de ontwikkeling van de diffusiestrategie Krachtvoer*. Maastricht: Maastricht University.
- Bessemers, K. (2010). Werkblad beschrijving interventie Krachtvoer. Retrieved 9 May 2011, from www.loketgezondleven.nl
- Bessemers, K., de Ruiter, S., & Buijs, G. (2006). *Toolkit Overgewicht*. Woerden: NIGZ.
- Bessemers, K. M. H. H., van Assema, P., Paulussen, T. G. W. M., & de Vries, N. K. (2011). Evaluation of an adoption strategy for a healthy diet programme for lower vocational schools. *Health Education Research*, 26(1), 89-105.
- Blake, S. M., Ledsky, R. A., Sawyer, R. J., Goodenow, C., Banspach, S., Lohrmann, D. K., et al. (2005). Local school district adoption of state-recommended policies on HIV prevention education. *Preventive Medicine*, 40(2), 239-248.
- Boekaerts, M., Rintrich, P. R., & Zeider, M. (2000). *Handbook of self regulation* (1 ed.). San Diego, CA: Academic Press.
- Boonen, A., de Vries, N., de Ruiter, S., Bowker, S., & Buijs, G. (2009). *HEPS Guidelines. Guidelines on promoting healthy eating and physical activity in schools*. Woerden: NIGZ.
- Boot, N., van Assema, P., Hesdahl, B., & de Vries, N. (2010a). Professional assistance in implementing schools health policies. *Health Education*, 110(4), 294-308.
- Boot, N. M. W. M., de Jongh, D. M., Leurs, M. T. W., & de Vries, N. K. (2011). Gezonde School als methode voor GGD'en bij de invoering van schoolgezondheidsbeleid. *Tijdschrift voor Gezondheidswetenschappen*, 89(4), 222-228.
- Boot, N. M. W. M., van Assema, P., Hesdahl, B., Leurs, M., & de Vries, N. K. (2010). Gezondheidsbevordering en voortgezet onderwijs: verstandshuwelijk of echte liefde? *Tijdschrift voor Gezondheidswetenschappen*, 88(3), 127-135.
- Borrelli, B., Sepinwall, D., Ernst, D., Bellg, A., Czajkowski, S., Breger, R., et al. (2005). A new tool to assess treatment fidelity and evaluation of treatment fidelity across 10 years of health behavior research. *Journal of Consulting and Clinical Psychology*, 73(5), 852-860.
- Bos, V., de Jongh, D. M., & Paulussen, T. G. W. M. (2010). *Gezondheidsbevordering en preventie in het onderwijs. Stand van zaken, effectiviteit en ervaringen van GGD'en en scholen* (No. RIVM-rapport 255001003/2010). Bilthoven: RIVM.
- Brink, S. G., Basen-Engquist, K. M., O'Hara-Tompkins, N. M., Parcel, G. S., Gottlieb, N. H., & Lovato, C. Y. (1995). Diffusion of an effective tobacco prevention program. Part I: Evaluation of the dissemination phase. *Health Education Research*, 10(3), 283-295.
- Brug, J., van Assema, P., & Kok, G. J. (1998). Misconceptie van consumptie van vet, groente en fruit: oorzaken en implicaties voor voedingsvoorlichting. *Tijdschrift voor Gezondheidswetenschappen*, 76, 17-23.
- Brug, J., van Dale, D., Lanting, L., Kremers, S., Veenhof, C., Leurs, M., et al. (2010). Towards evidence-based, quality-controlled health promotion: the Dutch recognition system for health promotion interventions. *Health Education Research*, 25(6), 1100-1106.
- Buckley, L., & Sheehan, M. (2009). A process evaluation of an injury prevention school-based programme for adolescents. *Health Education Research*, 24(3), 507-519.

- Buller, D. B., Buller, M. K., & Kane, I. (2005). Web-based strategies to disseminate a sun safety curriculum to public elementary schools and state-licensed child-care facilities. *Health Psychology, 24*(5), 470-476.
- Burrows, T. L., Martin, R. J., & Collins, C. E. (2010). A systematic review of the validity of dietary assessment methods in children when compared with the method of doubly labeled water. *Journal of the American Dietetic Association, 110*(10), 1501-1510.
- Buston, K., Wight, D., Hart, G., & Scott, S. (2002). Implementation of a teacher-delivered sex education programme: obstacles and facilitating factors. *Health Education Research, 17*(1), 59-72.
- Butler, H., Bowes, G., Drew, S., Glover, S., Godfrey, C., Patton, G., et al. (2008). Harnessing complexity: taking advantage of context and relationships in dissemination of school-based interventions. *Health Promotion Practice, 11*(2), 259-267.
- Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. *Implementation Science, 2*, 40.
- Centraal Bureau voor de Statistiek (2008). *Gezondheid en zorg in cijfers 2008*. Den Haag/ Heerlen: CBS.
- Centraal Bureau voor de Statistiek (2009). *Demografische kerncijfers per gemeente*. Den Haag/ Heerlen: CBS.
- Centraal Bureau voor de Statistiek (2010). *Jaarboek onderwijs in cijfers 2010*. Den Haag/ Heerlen: CBS.
- Centraal Bureau voor de Statistiek, & Sociaal Cultureel Planbureau (2008). *Armoedebereik 2008*. Den Haag/Heerlen, 2008: CBS & SCP.
- Contento, I. R. (2007). *Nutrition Education. Linking research, theory and practice*. Sudbury, MA: Jones and Bartlett Publishers.
- Crone, M. R., Verlaan, M., Willemssen, M. C., van Soelen, P., Reijneveld, S. A., Sing, R. A., et al. (2006). Sustainability of the prevention of passive infant smoking within well-baby clinics. *Health Education and Behavior, 33*(2), 178-196.
- de Bourdeaudhuij, I. (1997). Family food rules and healthy eating in adolescents. *Journal of Health Psychology, 2*(1), 45-56.
- de Ruiter, S. (2010). *VIMP aanvraag ZonMw 2010 - 2014. Landelijke implementatie Krachtvoer*. Woerden: NIGZ.
- de Vries, H., Dijkstra, M., & Kuhlman, P. (1988). Self-efficacy: the third factor besides attitude and subjective norm as a predictor of behavioral intentions. *Health Education Research 3*(3), 273-282.
- Derzon, J. H., Sale, E., Springer, J. F., & Brounstein, P. (2005). Estimating intervention effectiveness: synthetic projection of field evaluation results. *Journal of Primary Prevention, 26*(4), 321-343.
- Dobson, D., & Cook, T. J. (1980). Avoiding type 3 errors in program evaluation: results from a field experiment. *Evaluation and Program Planning, 3*(4), 269-276.
- Dowda, M., James, F., Sallis, J. F., McKenzie, T. L., Rosengard, P., & Kohl, H. W. (2005). Evaluating the sustainability of SPARK physical education: a case study of translating research into practice. *Research Quarterly for Exercise and Sport, 76*(1), 11-19.
- Dunton, G. F., Lagloire, R., & Robertson, T. (2009). Using the RE-AIM framework to evaluate the statewide dissemination of a school-based physical activity and nutrition curriculum: "Exercise Your Options". *American Journal of Health Promotion, 23*(4), 229-232.
- Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology 41*(3-4), 327-350.
- Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: implications for drug abuse prevention in school settings. *Health Education Research, 18*(2), 237-256.
- Dusenbury, L., Brannigan, R., Hansen, W. B., Walsh, J., & Falco, M. (2005). Quality of implementation: developing measures crucial to understanding the diffusion of preventive interventions. *Health Education Research, 20*(3), 308-313.
- Fleuren, M., Wiefferink, K., & Paulussen, T. (2004). Determinants of innovation within health care organizations. Literature review and Delphi study. *International Journal for Quality in Health Care, 16*(2), 107-123.

- Franks, A., Kelder, S. H., Dino, G. A., Horn, K. A., Gortmaker, S. L., Wiecha, J. L., et al. (2007). School-based programs: lessons learned from CATCH, Planet Health, and Not-On-Tobacco. *Preventing Chronic Disease*, 4(2), A33.
- French, S. A., & Stables, G. (2003). Environmental interventions to promote vegetable and fruit consumption among youth in school settings. *Preventive Medicine*, 37(6 Pt 1), 593-610.
- Fullan, M. (2001). *The new meaning of educational change*. (3 ed.). New York: Teachers College Press.
- Gezondheidsraad (2006). *Richtlijnen goede voeding 2006. Achtergronddocument*. Den Haag: Gezondheidsraad.
- Gingiss, P. M., & Boerm, M. (2009). Influence of funding cuts on Texas school tobacco programs. *Journal of School Health*, 79(8), 361-368; quiz 388-390.
- Glasgow, R. E. (2008). What types of evidence are most needed to advance behavioral medicine? *Annals of Behavioral Medicine*, 35(1), 19-25.
- Glasgow, R. E., Lichtenstein, E., & Marcus, A. C. (2003). Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health*, 93(8), 1261-1267.
- Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health*, 89(9), 1322-1327.
- Gratton, L., Povey, R., & Clark-Carter, D. (2007). Promoting children's fruit and vegetable consumption: interventions using the Theory of Planned Behaviour as a framework. *British Journal of Health Psychology*, 12(Pt 4), 639-650.
- Green, L. W., & Kreuter, M. W. (2005). *Health Program Planning: An Educational and Ecological Approach* (4 ed.). New York: McGraw-Hill.
- Green, L. W., Ottoson, J. M., Garcia, C., & Hiatt, R. A. (2009). Diffusion theory and knowledge dissemination, utilization, and integration in public health. *Annual Review of Public Health*, 30, 151-174.
- Gregory, A., Henry, D. B., & Schoeny, M. E. (2007). School climate and implementation of a preventive intervention. *American Journal of Community Psychology*, 40(3-4), 250-260.
- Gresham, F. M., Gansle, K. A., Noell, G. H., & Cohen, S. (1993). Treatment integrity of school-based behavioral intervention studies: 1980-1990. *School Psychology Review*, 22(2), 254-272.
- Haerens, L., Deforche, B., Maes, L., Cardon, G., Stevens, V., & de Bourdeaudhuij, I. (2006). Evaluation of a 2-year physical activity and healthy eating intervention in middle school children. *Health Education Research*, 21(6), 911-921.
- Han, S. S., & Weiss, B. (2005). Sustainability of teacher implementation of school-based mental health programs. *Journal of Abnormal Child Psychology*, 33(6), 665-679.
- Hanson, M. D., & Chen, E. (2007). Socioeconomic status and health behaviors in adolescence: a review of the literature. *Journal of Behavioral Medicine*, 30(3), 263-285.
- Hart, K. H., Bishop, J. A., & Truby, H. (2002). An investigation into school children's knowledge and awareness of food and nutrition. *Journal of Human Nutrition and Dietetics*, 15(2), 129-140.
- Haslam, D. W., & James, W. P. (2005). Obesity. *Lancet*, 366(9492), 1197-1209.
- Hoekstra, F., ter Beek, J., Wiefferink, K., & Buijs, G. (2007). Proefimplementatie van het PRIMA antipestbeleid op basisscholen. *Tijdschrift voor Gezondheidswetenschappen*, 85(4), 196-198.
- Hoelscher, D. M., Evans, A., Parcel, G. S., & Kelder, S. H. (2002). Designing effective nutrition interventions for adolescents. *Journal of the American Dietetic Association*, 102(3 Suppl), S52-63.
- Hoelscher, D. M., Feldman, H. A., Johnson, C. C., Lytle, L. A., Osganian, S. K., Parcel, G. S., et al. (2004). School-based health education programs can be maintained over time: results from the CATCH Institutionalization study. *Preventive Medicine*, 38(5), 594-606.
- Hoelscher, D. M., Kelder, S. H., Murray, N., Cribb, P. W., Conroy, J., & Parcel, G. S. (2001). Dissemination and adoption of the Child and Adolescent Trial for Cardiovascular Health (CATCH): a case study in Texas. *Journal of Public Health Management and Practice*, 7(2), 90-100.
- Inspectie van het Onderwijs (2009). *Toezichtkader 2009. Primair onderwijs, voortgezet onderwijs*. Utrecht.
- Jaime, P. C., & Lock, K. (2009). Do school based food and nutrition policies improve diet and reduce obesity? *Preventive Medicine*, 48(1), 45-53.

- Johnson, K. W., Ogilvie, K. A., Collins, D. A., Shamblen, S. R., Dirks, L. G., Ringwalt, C. L., et al. (2010). Studying implementation quality of a school-based prevention curriculum in frontier Alaska: application of video-recorded observations and expert panel judgment. *Prevention Science*, 11(3), 275-286.
- Johnstone, E., Knight, J., Gillham, K., Campbell, E., Nicholas, C., & Wiggers, J. (2006). System-wide adoption of health promotion practices by schools: evaluation of a telephone and mail-based dissemination strategy in Australia. *Health Promotion International* 21(3), 209-218.
- Jourdan, D., Mannix McNamara, P., Simar, C., Geary, T., & Pommier, J. (2010). Factors influencing the contribution of staff to health education in schools. *Health Education Research*, 25(4), 519-530.
- Kealey, K. A., Peterson, A. V., Jr., Gaul, M. A., & Dinh, K. T. (2000). Teacher training as a behavior change process: principles and results from a longitudinal study. *Health Education and Behavior*, 27(1), 64-81.
- Keij, I. (2000). *Standaarddefinitie allochtonen*. Heerlen: CBS.
- Knai, C., Pomerleau, J., Lock, K., & McKee, M. (2006). Getting children to eat more fruit and vegetables: a systematic review. *Preventive Medicine*, 42(2), 85-95.
- Kocken, P. (2008). *Automatisch gezonder? Resultaten van het school snack- en frisdrankautomatenproject*. Leiden: TNO Kwaliteit van Leven.
- Kolbe, L. J. (1986). Increasing the impact of school health promotion programs: emerging research perspectives. *Health Education*, 17(5), 47-52.
- Korenhof, M., Schreurs, B., Meijs, C., & de Laat, M. (2010). Netwerklernen in het onderwijs. *Onderwijsinnovatie*, 4, 17-24.
- Kothe, E. J., Mullan, B. A., & Amaratunga, R. (2011). Randomised controlled trial of a brief theory-based intervention promoting breakfast consumption. *Appetite*, 56(1), 148-155.
- Larson, N. I., Neumark-Sztainer, D., Hannan, P. J., & Story, M. (2007). Trends in adolescent fruit and vegetable consumption, 1999-2004: project EAT. *American Journal of Preventive Medicine*, 32(2), 147-150.
- Laurence, S., Peterken, R., & Burns, C. (2007). Fresh Kids: the efficacy of a Health Promoting Schools approach to increasing consumption of fruit and water in Australia. *Health Promotion International* 22(3), 218-226.
- Leurs, M. (2008). *A collaborative approach to tailored whole-school health promotion. The schoolBeat study*. Maastricht University, Maastricht.
- Leurs, M. T., Bessems, K., Schaalma, H. P., & de Vries, H. (2007). Focus points for school health promotion improvements in Dutch primary schools. *Health Education Research*, 22(1), 58-69.
- Livingstone, M. B., & Robson, P. J. (2000). Measurement of dietary intake in children. *Proceedings of the Nutrition Society*, 59(2), 279-293.
- Livingstone, M. B., Robson, P. J., & Wallace, J. M. (2004). Issues in dietary intake assessment of children and adolescents. *British Journal of Nutrition*, 92(Suppl. 2), S213-222.
- Martens, M. (2005). *The development, implementation, and evaluation of an educational programme for 12-14-year-old students to promote healthy eating*. Maastricht University, Maastricht.
- Martens, M., van Assema, P., Paulussen, T., Schaalma, H., & Brug, J. (2006). Krachtvoer: process evaluation of a Dutch programme for lower vocational schools to promote healthful diet. *Health Education Research*, 21(5), 695-704.
- Martens, M., Wind, M., van Assema, P., & Brug, J. (2002). De (on)mogelijkheden van voedingsvoorlichting aan twaalf- tot veertienjarige jongeren. *Nederlands Tijdschrift voor Diëtenisten* 57(4), 71-77.
- Martens, M. K., Bessems, K. M. H. H., & van Assema, P. (2007). Aanpassingsplan revisie Krachtvoer. Maastricht University.
- Martens, M. K., van Assema, P., & Brug, J. (2005). Why do adolescents eat what they eat? Personal and social environmental predictors of fruit, snack and breakfast consumption among 12-14-year-old Dutch students. *Public Health Nutrition*, 8(8), 1258-1265.
- Martens, M. K., van Assema, P., Paulussen, T. G. W. M., van Breukelen, G., & Brug, J. (2008). Krachtvoer: effect evaluation of a Dutch healthful diet promotion curriculum for lower vocational schools. *Public Health Nutrition*, 11(3), 271-278.

- McBride, N. T., Farrington, F. H., & Kennedy, C. A. (2007). Research to practice - formal dissemination of the School Health and Alcohol Harm Reduction Project (SHAHRP) in Australia. *Drug and Alcohol Review*, 26(6), 665-672.
- McClain, A. D., Chappuis, C., Nguyen-Rodriguez, S. T., Yaroch, A. L., & Spruijt-Metz, D. (2009). Psychosocial correlates of eating behavior in children and adolescents: a review. *International Journal of Behavioural Nutrition and Physical Activity*, 6, 54.
- McCormick, L. K., Steckler, A. B., & McLeroy, K. R. (1995). Diffusion of innovations in schools: a study of adoption and implementation of school-based tobacco prevention curricula. *American Journal of Health Promotion*, 9(3), 210-219.
- Mihas, C., Mariolis, A., Manios, Y., Naska, A., Arapaki, A., Mariolis-Sapsakos, T., et al. (2010). Evaluation of a nutrition intervention in adolescents of an urban area in Greece: short- and long-term effects of the VYRONAS study. *Public Health Nutrition*, 13(5), 712-719.
- Ministerie van Onderwijs Cultuur en Wetenschap (2006). *Karakteristieken voor de onderbouw VO. Kerndoelen voor de onderbouw VO*. Den Haag: Ministerie van OCW.
- Ministerie van Volksgezondheid Welzijn en Sport (2006). *Kiezen voor gezond leven*. Den Haag: Ministerie van VWS.
- Ministerie van Volksgezondheid Welzijn en Sport (2008). *Nota voeding en gezondheid. Gezonde voeding, van begin tot eind*. Den Haag: Ministerie van VWS.
- Ministerie van Volksgezondheid Welzijn en Sport (2011). *Gezondheid dichtbij. Landelijke nota gezondheidsbeleid*. Den Haag: Ministerie van VWS.
- Ministry of Education Culture and Science (Ed.). (2007). *The Education System in the Netherlands 2007*. The Hague: Dutch Eurydice Unit, Ministry of Education, Culture and Science.
- Neumark-Sztainer, D., Story, M., Hannan, P. J., & Rex, J. (2003). New Moves: a school-based obesity prevention program for adolescent girls. *Preventive Medicine*, 37(1), 41-51.
- Noonan, R. K., Emshoff, J. G., Mooss, A., Armstrong, M., Weinberg, J., & Ball, B. (2009). Adoption, adaptation, and fidelity of implementation of sexual violence prevention programs. *Health Promotion Practice*, 10(1 Suppl), 59S-70S.
- Oenema, A. (2004). *Promoting awareness of fat, fruit and vegetable intake*. Universiteit Maastricht, Maastricht.
- Oldenburg, B. F., Sallis, J. F., Ffrench, M. L., & Owen, N. (1999). Health promotion research and the diffusion and institutionalization of interventions. *Health Education Research*, 14(1), 121-130.
- Paineau, D., Beauvils, F., Boulier, A., Cassuto, D. A., Chwalow, J., Combris, P., et al. (2010). The cumulative effect of small dietary changes may significantly improve nutritional intakes in free-living children and adults. *European Journal of Clinical Nutrition*, 64(8), 782-791.
- Pankratz, M., Hallfors, D., & Cho, H. (2002). Measuring perceptions of innovation adoption: the diffusion of a federal drug prevention policy. *Health Education Research*, 17(3), 315-326.
- Parcel, G. S., O'Hara-Tompkins, N. M., Harrist, R. B., Basen-Engquist, K. M., McCormick, L. K., Gottlieb, N. H., et al. (1995). Diffusion of an effective tobacco prevention program. Part II: Evaluation of the adoption phase. *Health Education Research*, 10(3), 297-307.
- Paulus, P. (2009). Germany: Anschub.de - Alliance for sustainable School Health and Education. In C. E. Aldinger & C. V. Whitman (Eds.), *Case Studies in Global School Health Promotion From Research to Practice* (pp. 195-203). New York: Springer Science & Business Media.
- Paulussen, T., Kok, G., & Schaalma, H. (1994). Antecedents to adoption of classroom-based AIDS education in secondary schools. *Health Education Research*, 9(4), 485-496.
- Paulussen, T., Kok, G., Schaalma, H., & Parcel, G. S. (1995). Diffusion of AIDS curricula among Dutch secondary school teachers. *Health Education Quarterly*, 22(2), 227-243.
- Paulussen, T., Panis, R., Peters, L., Buijs, G., & Wijnsma, P. (1998). *Stand van zaken schoolgezondheidsbeleid in Nederland*. Woerden: NIGZ.
- Paulussen, T., Wiefferink, K., & Mesters, I. (2007). Invoering van effectief gebleken interventies. In: gezondheidsvoorlichting en gedragsverandering. In J. Brug, P. van Assema & L. Lechner (Eds.), *Gezondheidsvoorlichting en gedragsverandering*. Assen: Van Gorcum.
- Pollard, J., Wild, C. P., White, K. L., Greenwood, D. C., Cade, J. E., & Kirk, S. F. (2003). Comparison of plasma biomarkers with dietary assessment methods for fruit and vegetable intake. *European Journal of Clinical Nutrition*, 57(8), 988-998.

- Preziosi, P., Galan, P., Deheeger, M., Yacoub, N., Drewnowski, A., & Herberg, S. (1999). Breakfast type, daily nutrient intakes and vitamin and mineral status of French children, adolescents, and adults. *Journal of the American College of Nutrition*, 18(2), 171-178.
- Proctor, E., Silmere, H., Raghavan, R., Hovmand, P., Aarons, G., Bunker, A., et al. (2011). Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Administration and Policy in Mental Health and Mental Health Services Research* 38(2), 65-76.
- Raaijmakers, L., & Bessems, K. (2008). *Samenvatting focusgroepen actieplannen Krachtvoer*. Maastricht: Maastricht University.
- Raaijmakers, L. G. M., Bessems, K. M. H. H., Kremers, S. P. J., & van Assema, P. (2009). Breakfast consumption among children and adolescents in the Netherlands. *European Journal of Public Health*, 20(3), 318-324.
- Rampersaud, G. C., Pereira, M. A., Girard, B. L., Adams, J., & Metzl, J. D. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association*, 105(5), 743-760; quiz 761-742.
- Rasmussen, M., Krolner, R., Klepp, K. I., Lytle, L., Brug, J., Bere, E., et al. (2006). Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies. *International Journal of Behavioural Nutrition and Physical Activity*, 3, 22.
- Reinaerts, E., Crutzen, R., Candel, M., de Vries, N. K., & de Nooijer, J. (2008). Increasing fruit and vegetable intake among children: comparing long-term effects of a free distribution and a multicomponent program. *Health Education Research*, 23(6), 987-996.
- Resnicow, K., Davis, M., Smith, M., Lazarus-Yaroch, A., Baranowski, J., et al. (1998). How best to measure implementation of school health curricula: a comparison of three measures. *Health Education Research*, 13(2), 239-250.
- Reubsat, A., Reinaerts, E. B., Brug, J., van Hooff, J. P., & van den Borne, H. W. (2004). Process evaluation of a school-based education program about organ donation and registration, and the intention for continuance. *Health Education Research*, 19(6), 720-729.
- Reynolds, K. D., Franklin, F. A., Leviton, L. C., Maloy, J., Harrington, K. F., Yaroch, A. L., et al. (2000). Methods, results, and lessons learned from process evaluation of the high 5 school-based nutrition intervention. *Health Education and Behavior*, 27(2), 177-186.
- Ringwalt, C., Pankratz, M., Gottfredson, N., Jackson-Newsom, J., Dusenbury, L., Giles, S., et al. (2009). The effects of students' curriculum engagement, attitudes toward their teachers, and perception of their teachers' skills on school-based prevention curriculum outcomes. *Journal of Drug Education*, 39(3), 223-237.
- RIVM (2004). *Ons eten gemeten* (No. RIVM Rapport 270555007). Bilthoven: RIVM.
- RIVM (2010). *Handleiding Gezonde School. Toelichting voor gebruikers*. Bilthoven: RIVM.
- Roberts-Gray, C., Solomon, T., Gottlieb, N., & Kelsey, E. (1998). Heart Partners: a strategy for promoting effective diffusion of school health promotion programs. *Journal of School Health*, 68(3), 106-110.
- Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.
- Rohrbach, L. A., Graham, J. W., & Hansen, W. B. (1993). Diffusion of a school-based substance abuse prevention program: predictors of program implementation. *Preventive Medicine*, 22(2), 237-260.
- Rohrbach, L. A., Grana, R., Sussman, S., & Valente, T. W. (2006). Type II translation: transporting prevention interventions from research to real-world settings. *Evaluation & the Health Professions*, 29(3), 302-333.
- Rohrbach, L. A., Ringwalt, C. L., Ennett, S. T., & Vincus, A. A. (2005). Factors associated with adoption of evidence-based substance use prevention curricula in US school districts. *Health Education Research*, 20(5), 514-526.
- Sherwood, N. E., Wall, M., Neumark-Sztainer, D., & Story, M. (2009). Effect of socioeconomic status on weight change patterns in adolescents. *Preventing Chronic Disease*, 6(1), A19.
- Singh, A. S., Chin, A. P. M. J., Brug, J., & van Mechelen, W. (2009). Dutch obesity intervention in teenagers: effectiveness of a school-based program on body composition and behavior. *Archives of Pediatrics & Adolescent Medicine*, 163(4), 309-317.

- Sjoberg, A., Hallberg, L., Hoglund, D., & Hulthen, L. (2003). Meal pattern, food choice, nutrient intake and lifestyle factors in The Goteborg Adolescence Study. *European Journal of Clinical Nutrition*, 57(12), 1569-1578.
- Sniehotta, F. F. (2009). Towards a theory of intentional behaviour change: plans, planning, and self-regulation. *British Journal of Health Psychology*, 14(Pt 2), 261-273.
- Sociaal Cultureel Planbureau (2003). *Autochtone achterstandsleerlingen: een vergeten groep*. Den Haag: SCP.
- Sociaal Cultureel Planbureau (2006). *Statusscores postcodegebieden*. Den Haag: SCP.
- St Leger, L. (2004). What's the place of schools in promoting health? Are we too optimistic? *Health Promotion International*, 19(4), 405-408.
- St Pierre, T. L., & Kaltreider, D. L. (2004). Tales of refusal, adoption, and maintenance: evidence-based substance abuse prevention via school-extension collaborations. *American Journal of Evaluation*, 25(4), 479-491.
- Steckler, A., & Linnan, L. (2002). *Process evaluation for public health interventions and research* (1 ed.). San Francisco, CA: Jossey-Bass.
- Stevens, V., van Oost, P., & de Bourdeaudhuij, I. (2001). Implementation Process of the Flemish Antibullying Intervention and Relation with Program Effectiveness. *Journal of School Psychology*, 39(4), 303-317.
- Sy, A., & Glanz, K. (2008). Factors influencing teachers' implementation of an innovative tobacco prevention curriculum for multiethnic youth: Project SPLASH. *Journal of School Health*, 78(5), 264-273.
- Tak, N. I., te Velde, S. J., & Brug, J. (2009). Long-term effects of the Dutch Schoolgruitem Project -- Promoting fruit and vegetable consumption among primary-school children. *Public Health Nutrition*, 12(8), 1213-1223.
- Telzrow, C. F., McNamara, K., & Hollinger, C. L. (2000). Fidelity of Problem-Solving Implementation and Relationship to Student Performance. *School Psychology Review*, 29(n3), 443-461.
- Thaker, S., Steckler, A., Sánchez, V., Khatapoush, S., Rose, J., & Hallfors, D. D. (2008). Program characteristics and organizational factors affecting the implementation of a school-based indicated prevention program *Health Education Research*, 23(11), 238-248.
- Thompson, F. E., & Subar, A. F. (2008). Dietary assessment methodology. In A. M. Coulston & C. J. Boushey (Eds.), *Nutrition in the prevention and treatment of disease* (2 ed.). Burlington, MA: Elsevier.
- TNO (2004). *Resultaten van de Voedselconsumptiepeiling 2003* (No. V6000). Zeist: TNO Voeding.
- van Assema, P., Brug, J., Ronda, G., & Steenhuis, I. (2001). The relative validity of a short Dutch questionnaire as a means to categorize adults and adolescents to total and saturated fat intake. *Journal of Human Nutrition and Dietetics*, 14(5), 377-390.
- van Assema, P., Brug, J., Ronda, G., Steenhuis, I., & Oenema, A. (2002). A short Dutch questionnaire to measure fruit and vegetable intake: relative validity among adults and adolescents. *Nutrition and Health*, 16(2), 85-106.
- van Cauwenberghe, E., Maes, L., Spittaels, H., van Lenthe, F. J., Brug, J., Oppert, J. M., et al. (2010). Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. *British Journal of Nutrition*, 103(6), 781-797.
- van den Bogaert, E. H. A. (2011). *Een studie naar het voortdueren van het Krachtvoer programma op het voortgezet onderwijs*. Maastricht University.
- van den Hurk, K., van Dommelen, P., van Buuren, S., Verkerk, P. H., & HiraSing, R. A. (2007). Prevalence of overweight and obesity in the Netherlands in 2003 compared to 1980 and 1997. *Archives of Disease in Childhood*, 92, 992-995.
- van der Horst, K., Timperio, A., Crawford, D., Roberts, R., Brug, J., & Oenema, A. (2008). The School Food Environment: Associations with Adolescent Soft Drink and Snack Consumption. *American Journal of Preventive Medicine*, 35(3), 217-223.
- Voedingscentrum (2006). *Assortimentsmeter*. Den Haag.
- Voedingscentrum (2011). *Richtlijnen voedselkeuze*. Den Haag.

- Wang, D., Ou, C. Q., Chen, M. Y., & Duan, N. (2009). Health-promoting lifestyles of university students in mainland China. *BMC Public Health*, 9, 379.
- Warren, J. M., Henry, C. J., Lightowler, H. J., Bradshaw, S. M., & Perwaiz, S. (2003). Evaluation of a pilot school programme aimed at the prevention of obesity in children. *Health Promotion International*, 18(4), 287-296.
- Wiecha, J. L., El Ayadi, A. M., Fuemmeler, B. F., Carter, J. E., Handler, S., Johnson, S., et al. (2004). Diffusion of an integrated health education program in an urban school system: planet health. *Journal of Pediatric Psychology*, 29(6), 467-474.
- Wiefferink, C. H., Poelman, J., Linthorst, M., Vanwesenbeeck, I., van Wijngaarden, J. C. M., & Paulussen, T. G. W. (2005). Outcomes of a systematically designed strategy for the implementation of sex education in Dutch secondary schools. *Health Education Research*, 20(3), 323-333.
- Wilson, K. D., & Kurz, R. S. (2008). Bridging implementation and institutionalization within organizations: proposed employment of continuous quality improvement to further dissemination. *Journal of Public Health Management and Practice*, 14(2), 109-116.
- Wilson, K. L., & Wiley, D. C. (2009). Influence of materials on teacher adoption of abstinence-only-until-marriage programs. *Journal of School Health*, 79(12), 565-574.
- Wind, M., Bjelland, M., Perez-Rodrigo, C., te Velde, S. J., Hildonen, C., Bere, E., et al. (2008). Appreciation and implementation of a school-based intervention are associated with changes in fruit and vegetable intake in 10- to 13-year old schoolchildren - the Pro Children study. *Health Education Research*, 23(6), 997-1007.
- Windsor, R., Clark, N., Boyd, N. R., & Goodman, R. M. (2004). *Evaluation of Health Promotion, Health Education and Disease Prevention Programs* (3 ed.). New York: McGraw-Hill.
- World Cancer Research Fund, & American Institute for Cancer Research (2007). *Food, nutrition, physical activity and the prevention of cancer: a global perspective* Washington D.C.: WCRF and AICR.
- World Health Organization (1998). *WHO information series on school health. Document four. Healthy nutrition: An essential element of a Health-Promoting School*: WHO.
- World Health Organization (2003). *Diet, nutrition and prevention of chronic diseases. WHO technical report series* (No. 916). Geneva: WHO.
- World Health Organization (2005). *Preventing chronic diseases: a vital investment*. Geneva: WHO.
- World Health Organization (2008). *Inequalities in young people's health. HBSC international report from the 2005/2006 survey*. Copenhagen: WHO.
- Young, D. R., Steckler, A., Cohen, S., Pratt, C., Felton, G., Moe, S. G., et al. (2008). Process evaluation results from a school- and community-linked intervention: the Trial of Activity for Adolescent Girls (TAAG). *Health Education Research*, 23(6), 976-986.
- Young, I., & Lee, A. (2009). Scotland: Sustaining the development of Health-Promoting Schools: the experience of Scotland in the European Context. In C. E. Aldinger & C. V. Whitman (Eds.), *Case Studies in Global School Health Promotion From Research to Practice* (pp. 225-238). New York: Springer Science & Business Media.

Summary

Summary

Krachtvoer is a Dutch school-based healthy diet programme intended for students in the first and second years of the three highest educational subtracks of prevocational schools. It aims at increasing the consumption of fruit, achieving a daily healthy breakfast, and decreasing the consumption of fats by replacing high-fat snacks (e.g. chocolate, potato chips) by non-fat or low-fat snacks (e.g. chewing gum, acid drops). The programme comprises eight lessons and is administered by teachers care and biology. The programme was first developed and evaluated during a PhD project, which was completed in 2005. Overall, the results of this evaluation were promising, but also indicated that several programme elements needed to be improved. It was concluded that more support was needed for programme implementation. In order to have a public health impact, the programme not only needed adjustments to fit a broader target group, but also had to be adopted, implemented and used continually on a large scale. This thesis presents the results of a second PhD project on Krachtvoer that started in 2006. The project's aims were revising the first edition of the programme and evaluating the effects of the adapted programme. Furthermore, a programme dissemination strategy was developed and evaluated. A final aim of this project was exploring the determinants of programme dissemination.

Chapter 1 of this thesis introduces the Krachtvoer programme and the Krachtvoer dissemination strategy in terms of rationale, aims, theoretical foundations, revision process, and actual content. The chapter further illustrates how the programme and dissemination strategy fit in the current Dutch educational and health promotion systems.

Chapter 2 describes the process evaluation study of the Krachtvoer programme. Teacher logbooks, telephone interviews with teachers, and student questionnaires were used to assess teacher and student programme appreciation. Further, completeness of programme implementation and adherence to programme implementation were examined, as well as the relations between programme appreciation and completeness of implementation. Results indicated favourable levels of teacher and student appreciation for the programme in general as well as the revised elements. Girls, first-year students and students with more favourable dietary intakes particularly appreciated individual programme elements. Levels of completeness of implementation were high, but several teachers did not adhere to the intended implementation period. Some moderately strong relations between teacher appreciation and completeness of implementation scores were found. It was concluded that the programme revisions resulted in a

programme that was well appreciated, also by the extended target group, and was implemented to a considerable degree of completeness. Teacher appreciation proved potentially important for completeness of implementation. Several aspects requiring improvement were identified, indicating the importance of continued programme evaluation and updates.

Chapter 3 describes the effect evaluation study of the programme. A cluster randomized controlled trial was conducted. Students completed questionnaires at baseline (1-4 weeks before implementation), at posttest (1-4 weeks after implementation), and at the repeated posttest (6 months after implementation). Data were collected among 1117 students of 13 experimental schools and 758 students of 11 control schools. In the short and longer term, favourable intervention effects were revealed on fruit consumption. Further, short-term favourable effects on fruit juice consumption were revealed. Intervention effects on breakfast intakes were limited. Although no changes in snack frequency were reported, students did make healthier snack choices as a result of the programme. It was concluded that the breakfast lessons should be excluded from the next version of the programme. Nationwide dissemination of the fruit and snack lessons of the programme was recommended. To optimize effects on dietary behaviours, the programme should be incorporated as a component of a more comprehensive whole-school approach, targeting environmental influences as well.

Chapter 4 presents the results of a dose-response study. The study aimed to examine the relation between students' short- and longer-term changes in self-reported fruit, snack and breakfast consumption, and the teacher-reported level of completeness of implementation of the Krachtvoer programme and of specific elements (i.e. lessons and optional activities). Results indicated that completeness of programme implementation was positively related to increased fruit consumption in the short term. Implementation completeness of the tasting and recipe preparation activities, and a practical lesson on advertisements were both related to short- and longer-term increases in fruit consumption. No relations were found for snack and breakfast consumption. It was concluded that high levels of completeness of programme implementation are important for achieving the programme goal of increased fruit consumption. This is especially true for completeness of the practical programme elements. These outcomes imply that efforts should be taken to help teachers achieve high levels of completeness of programme implementation.

Chapter 5 presents the results of the evaluation of the Krachtvoer adoption study. Health promotion professionals from five Regional Public Health Services in the Netherlands were asked to recruit a total of 25 schools for the

Krachtvoer programme in accordance with this strategy. Interviews with health promotion professionals were held on their adherence to the proposed adoption strategy in practice, their appreciation of the adoption strategy and the barriers they faced implementing the adoption strategy. Further, the health promotion professionals indicated whether the specific steps of the adoption strategy were facilitating, neutral or counterproductive for the adoption process. In order to calculate the adoption rate, health promotion professionals kept records of teachers' negative and positive programme adoption decisions. Finally, telephone interviews with adopting and rejecting teachers were held to explore reasons for their adoption decisions. Results indicated that the health promotion professionals' adherence to the strategy was good, as well as their appreciation of the strategy. The health promotion professionals considered the person-to-person approach that characterized this adoption strategy, important but time-consuming. Overall, the strategy led to a favourable adoption rate. The diversity of reasons for adopting or rejecting the programme revealed the complexity of teachers' decision making. It was concluded that, although the adoption strategy and the programme itself could be further improved, especially changed socio-political conditions would lead to further increases in programme adoption.

Chapter 6 describes the results of the implementation study among teachers, in which determinants of teachers' implementation completeness of Krachtvoer and their intention towards programme continuation were assessed. Completeness of programme implementation was measured by means of a teacher logbook. Intention to continue the programme in the next school year was assessed with a baseline and a posttest questionnaire. These questionnaires also assessed implementation-related determinants. Results showed that teachers who implemented the fewest programme elements, had lower baseline scores on the teacher-related determinant 'self-efficacy' and higher baseline scores on the context-related determinant 'subjective norm from colleagues', than teachers who implemented the most programme elements. Teachers with a negative to neutral intention to continue using the programme the next school year at posttest, scored lower on several teacher-, programme- and context-related determinants than teachers with a positive intention to continue using the programme. Changes in determinant scores revealed that teachers whose intention did not increase after programme implementation scored lower on some teacher- and context-related determinants than increased intenders. The group of teachers as a whole showed some favourable and some unfavourable changes from baseline to posttest in terms of teacher-, programme- and context-related determinants. It was concluded that higher levels of completeness of programme

implementation could be achieved by an adapted kick-off meeting for teachers including feedback principles, and by creating an online programme community. With regard to programme continuation, it was considered important to create realistic expectations before implementation and to involve coordinators at the schools if the programme should be incorporated across an entire school. Programme-related determinants, especially programme compatibility, should be improved by involving teachers more closely in the continued programme updates.

Chapter 7 describes a summary of the main findings, discusses some methodological considerations, and describes the activities undertaken for the national dissemination campaign of the programme during and immediately after the pilot implementation project. The chapter then presents the implications of the findings for practice, theory and further research. The main conclusion is that the Krachtvoer programme is a promising tool to change fruit and snack consumption among students in prevocational schools. Other strategies might be necessary to change breakfast consumption. The effects on fruit intake and snack choices justify the current nationwide programme dissemination. Krachtvoer should preferably be disseminated as a component of a more comprehensive whole-school approach. Continued programme updates and reproduction of evaluation studies are important. The achieved levels of programme adoption, implementation and continuation are promising. However the feasibility of implementing the dissemination strategy by regional public health services in real-life settings is questionable. Further progress in the dissemination of health promotion interventions will require more high-quality studies on this subject, especially in non-experimental settings.

Samenvatting

Samenvatting

Krachtvoer is een Nederlands lesprogramma over voeding voor leerlingen van de eerste twee jaren van het vmbo. Het programma is ontwikkeld voor de drie hoogste niveaus van het vmbo en heeft als doel dat leerlingen meer fruit gaan eten, elke dag gezond gaan ontbijten, en vetrijke tussendoortjes (zoals chocolade, chips) vervangen door minder vette of geen tussendoortjes. Krachtvoer bestaat uit acht lessen die worden gegeven door docenten verzorging en biologie. Het programma werd voor het eerst ontwikkeld en geëvalueerd tijdens een eerder promotieonderzoek dat in 2005 werd afgerond. Over het algemeen waren de resultaten van de evaluatie van het programma veelbelovend, maar bepaalde programmaonderdelen moesten worden verbeterd. Daarnaast moest de implementatie van het programma worden verbeterd. Er werd geconcludeerd dat het programma moest worden aangepast aan een bredere doelgroep om een effect op de volksgezondheid te hebben. Grootschalige adoptie, implementatie en continuering van het programma was eveneens nodig om effecten te bereiken. Dit proefschrift rapporteert over de resultaten van een tweede promotieonderzoek, dat startte in 2006. Dit project was erop gericht de eerste versie van het Krachtvoer lesprogramma te herzien en het herziene programma te evalueren. Daarnaast had het project tot doel een verspreidingsstrategie voor het programma te ontwikkelen en te evalueren. Een laatste doel van het project was meer inzicht krijgen in de determinanten van programmaverspreiding.

In *hoofdstuk 1* van dit proefschrift worden het lesprogramma Krachtvoer en de Krachtvoer verspreidingsstrategie geïntroduceerd. Er wordt ingegaan op de beweegredenen, de doelstellingen, de theoretische onderbouwing, het revisieproces, en de daadwerkelijke inhoud van het programma en de verspreidingsstrategie. Het hoofdstuk belicht ook hoe het programma en de verspreidingsstrategie passen binnen het huidige Nederlandse onderwijssysteem en systeem van gezondheidsbevordering.

Hoofdstuk 2 rapporteert over de procesevaluatie van Krachtvoer. Er werd gebruik gemaakt van docentenlogboeken, telefonische interviews met docenten en leerlingenvragenlijsten. Hiermee werd onderzocht hoe leerlingen en docenten het programma waardeerden, en hoe volledig en getrouw docenten de lessen implementeerden. Daarnaast werden de relaties tussen programmawaardering en volledigheid van de implementatie onderzocht. Uit de resultaten bleek dat docenten en leerlingen het programma over het algemeen goed waardeerden. Ook waren ze tevreden over de herziene onderdelen. Meisjes, eerstejaarsleerlingen en leerlingen die vooraf al gezonder aten, waardeerden specifieke programma-elementen beter. De mate van volledig-

heid van de implementatie was hoog, hoewel een aantal docenten zich niet hield aan de beoogde implementatieperiode. Daarnaast werden er enkele matig sterke relaties gevonden tussen programmawaardering door docenten en volledigheid van de implementatie. Geconcludeerd werd dat de programma-aanpassingen hebben geresulteerd in een programma dat goed werd gewaardeerd, ook door de bredere doelgroep. Het programma werd uitgevoerd met een hoge mate van volledigheid. Programmawaardering door docenten bleek mogelijk belangrijk te zijn voor de volledigheid van de implementatie. Verschillende elementen die kunnen worden verbeterd, werden geïdentificeerd. Dit benadrukt het belang van continue programma-evaluaties en updates.

Hoofdstuk 3 beschrijft het effectevaluatieonderzoek van het lesprogramma. Een cluster gerandomiseerde gecontroleerde trial werd uitgevoerd. Leerlingen vulden vragenlijsten in op de voormeting (na één tot vier weken voorafgaand aan de lessen), op de nameting (na één tot vier weken na programma-implementatie) en op een herhaalde nameting (zes maanden na programma-implementatie). Er werden gegevens verzameld onder 1117 leerlingen van 13 experimentele scholen en 758 leerlingen van 11 controlescholen. Op de korte en lange termijn werden positieve effecten van het programma gevonden op de fruitconsumptie. Daarnaast werden op korte termijn gunstige effecten op de consumptie van vruchtensap gevonden. Er waren vrijwel geen wenselijke interventie-effecten op ontbijtconsumptie. Er was geen verandering in de frequentie waarmee leerlingen tussendoortjes aten, maar leerlingen bleken wel gezondere tussendoortjeskeuzes te maken als gevolg van het programma. Er werd geconcludeerd dat de lessen over ontbijt uit een volgende editie van het programma moesten worden gehaald. Landelijke verspreiding van lessen over fruit en tussendoortjes werd wel aanbevolen. Voor het optimaliseren van effecten op voedingsgedrag werd aanbevolen het programma op te nemen als een onderdeel van een meer omvattende aanpak van gezondheid binnen de school, waarbij ook aandacht is voor de omgeving.

Hoofdstuk 4 presenteert de resultaten van een dosisrespons studie. De studie onderzocht de relatie tussen korte en langere termijn veranderingen in de zelf-gerapporteerde fruit-, tussendoortjes- en ontbijtconsumptie, en de door de docent gerapporteerde mate van volledigheid van de implementatie van het lesprogramma Krachtvoer en van specifieke onderdelen (lessen en keuze-activiteiten). Uit de resultaten bleek dat de volledigheid van de implementatie van het programma positief gerelateerd was aan een toename van de fruitconsumptie op de korte termijn. Volledigheid van de implementatie van de praktische lessen gericht op proeven, het bereiden van recepten en een les over reclame, waren gerelateerd aan een toename van de fruitconsumptie op de

korte en langere termijn. Voor tussendoortjes- en ontbijtconsumptie werden geen relaties gevonden. Geconcludeerd werd dat een hoge mate van volledigheid van de programma-implementatie, en vooral praktische programma-elementen, van belang zijn voor het bereiken van een toename in fruitconsumptie. Dit impliceert dat de docenten gestimuleerd en geholpen moeten worden een hoge mate van volledigheid van de programma-implementatie te bereiken.

In *hoofdstuk 5* worden de resultaten van de evaluatie van de Krachtvoer adoptiestudie gepresenteerd. Aan functionarissen Gezondheidsbevordering van vijf Nederlandse GGD'en werd gevraagd om in totaal 25 scholen te werven voor Krachtvoer aan de hand van een adoptiestrategie. Er werden interviews gehouden met de functionarissen gezondheidsbevordering over de naleving van de adoptiestrategie in praktijk, hun waardering van de adoptiestrategie en de barrières waarmee ze geconfronteerd werden bij de implementatie van de adoptiestrategie. Daarnaast gaven de functionarissen gezondheidsbevordering aan in hoeverre de specifieke stappen van de adoptiestrategie bevorderend, neutraal of contraproductief waren voor het adoptieproces. Om het percentage programma-adoptie te berekenen, registreerden de functionarissen gezondheidsbevordering of de docenten negatieve of positieve adoptiebeslissingen namen. Tenslotte werden telefonische interviews gehouden met docenten die het programma wel of niet adopteerden over de redenen van hun beslissing. Uit de resultaten bleek dat de functionarissen gezondheidsbevordering de adoptiestrategie goed naleefden en waardeerden. De functionarissen gezondheidsbevordering vonden de persoonlijke benadering, die kenmerkend was voor de adoptiestrategie, belangrijk maar tijdrovend. Het percentage adoptie als resultaat van de strategie was goed. De diversiteit van de redenen die docenten noemden voor hun besluit Krachtvoer wel of niet te adopteren gaf aan hoe complex het besluitvormingsproces was. Geconcludeerd werd dat, hoewel er enige ruimte is voor verbetering van de adoptiestrategie en het lesprogramma zelf, vooral veranderingen in de sociaal-politieke context nodig zijn om verdere programma-adoptie te realiseren.

Hoofdstuk 6 beschrijft de resultaten van het implementatieonderzoek onder docenten, waarin determinanten van de volledigheid van de implementatie van Krachtvoer werden onderzocht. Volledigheid van implementatie werd gemeten met behulp van docentenlogboeken. De intentie om het programma in het volgende schooljaar voort te zetten, werd voorafgaand aan de lessen en na afloop van de lessen gemeten door middel van een voormetingvragenlijst en een nametingvragenlijst. De vragenlijsten registreerden ook determinanten van implementatie. Uit de resultaten bleek dat docenten die het minst aantal programma-onderdelen implementeerden, voorafgaand aan de lessen lager

scoorden op de docentgerelateerde determinant 'eigen effectiviteit' en hoger scoorden op de contextgerelateerde determinant 'subjectieve norm van collega's', dan leraren die de meeste programma-onderdelen implementeerden. Docenten met een negatieve of neutrale intentie om het programma het volgende schooljaar te blijven gebruiken, scoorden na afloop van de lessen lager op diverse docent-, programma- en contextgerelateerde determinanten, dan leraren met een positieve intentie om verder te gaan met het programma. Veranderingen in scores op determinanten toonden dat docenten met een niet-verhoogde intentie na de implementatie van het programma, lager scoorden op sommige docent- en contextgerelateerde determinanten, dan docenten met een toegenomen intentie. In de totale groep docenten waren zowel gunstige als ongunstige voormeting-nameting veranderingen zichtbaar op het gebied van docent-, programma- en contextgerelateerde determinanten. Geconcludeerd werd dat de volledigheid van de programma-implementatie kan toenemen door de startbijeenkomst voor docenten aan te passen door meer gebruik te maken van feedback, en door het ontwikkelen van een online programma community. Met betrekking tot de continuering, is het belangrijk om realistische verwachtingen te creëren voor de implementatie van het programma. Daarbij zouden coördinatoren van scholen betrokken moeten worden om te bereiken dat het programma wordt opgenomen in de hele school. Programmagerelateerde determinanten, en in het bijzonder de compatibiliteit van het programma, moet worden verbeterd door docenten nog meer te betrekken bij verdere aanpassingen in het programma.

Hoofdstuk 7 bevat een samenvatting van de belangrijkste bevindingen, bespreekt een aantal methodologische overwegingen, en beschrijft de activiteiten voor de nationale verspreiding van het programma tijdens en direct na het proefimplementatie-project. Het hoofdstuk presenteert vervolgens de implicaties voor de praktijk, theorie en verder onderzoek. De hoofdconclusie is dat Krachtvoer een veelbelovend programma is om fruit en tussendoortjesconsumptie onder leerlingen van het vmbo te veranderen. Voor het veranderen van ontbijtconsumptie zijn andere strategieën nodig. De effecten op fruit en tussendoortjesconsumptie rechtvaardigen de huidige landelijke verspreiding van het programma. Dit zou bij voorkeur als onderdeel van een meer omvatten-e bredere school aanpak van gezondheid moeten worden uitgevoerd. Voortdurende programma-aanpassingen en herhaalde evaluaties zijn hierbij belangrijk. De mate van programma-adoptie, -implementatie en -continuering die werden behaald zijn veelbelovend. Toch is de haalbaarheid van de verspreidingsstrategie door GGD' en in praktijk twijfelachtig. Om een stap verder te komen met het verspreiden van gezondheidsbevorderende

programma's, is meer kwalitatief goed onderzoek over dit onderwerp nodig, vooral in een niet-experimentele setting.

Dankwoord

Dankwoord

Graag wil ik iedereen bedanken die op enige wijze heeft bijgedragen aan de totstandkoming van dit proefschrift. Een bijzonder woord van dank aan mijn promotieteam:

Patricia, jij was voor mij een echte mentor. Jij wist mij keer op keer te stimuleren mijn grenzen te verleggen en een betere onderzoeker te worden. Bedankt voor je enthousiasme en vertrouwen!

Nanne, mede dankzij jouw inzet wordt Krachtvoer momenteel landelijk ingevoerd. Je stimuleerde me om dit onderzoeksproject in een breder kader te plaatsen. Bedankt!

Theo, gebruik maken van jouw ervaring met implementatieonderzoek in het onderwijs was voor mij een rijkdom. Met jouw optimistische opbouwende feedback wist je je kennis goed over te brengen.

Marloes, Krachtvoer was 'jouw kindje' tijdens je eigen promotietraject, maar ook tijdens dit tweede promotietraject heb je een belangrijke rol gespeeld. Bedankt voor je pragmatische aanpak bij de herziening van Krachtvoer en je eindeloze enthousiasme. Lieke, jij hebt je op zoveel vlakken voor Krachtvoer ingezet, zowel praktisch als inhoudelijk. Wat is het fijn om met iemand als jij te kunnen sparren over hoe we weer een stap verder konden komen. Silvia, als oud-collega's en vriendinnen werken we nog steeds samen nu je de landelijke coördinator van Krachtvoer bent. Bedankt voor je inzet!

Een speciaal woord van dank aan de functionarissen Gezondheidsbevordering van de GGD'en die hebben deelgenomen aan het proefimplementatieproject, te weten Nicke Rutten en Christianne Hardy van de GGD Zuid Limburg, Eef Holman en Ank Simons van de GGD Hollands Midden, Corine van Dijk en Fenneke Groenwegen van de GGD Midden Nederland, Eugenie Botden en Floortje Lagendijk van de GGD Hart voor Brabant en Christien Pieterse van de GGD Gelre IJssel. Bedankt voor het delen van zoveel kennis, jullie inzet en flexibiliteit.

Dank aan alle docenten en leerlingen van de vmbo-scholen die enthousiast hebben deelgenomen aan dit project en het onderzoek. Een kijkje in de keuken is zó leuk en zó waardevol!

Dit huidige proefimplementatie project Krachtvoer is een gezamenlijk initiatief van de Universiteit Maastricht, het Voedingscentrum, de Nederlandse

Hartstichting, het NIGZ en TNO Kwaliteit van Leven. Een speciaal woord van dank aan iedereen die op enige wijze een bijdrage heeft geleverd aan de ontwikkeling van Krachtvoer, de advisering bij het onderzoek en/of aan realisatie van de landelijke invoering van Krachtvoer, te weten vanuit het Voedingscentrum (Claudia van Zoelen, Jeltje Snel, Boudewijn Breedveld), de Nederlandse Hartstichting (Nynke Dijkstra (+), Karen van Reenen, Mariëlle de Waal, Marja van Oeckelen), het NIGZ (Silvia de Ruiten, Jan Jansen, Jessica Hoek, Fatma Alakay, Ilona de Gouw, Zeina Dafesh), ResCon (Marloes Martens), Laverbe (Yuliana Lie, Anet Huiskens), de GGD Rivierenland (Irmgard Leferink), TNO Kwaliteit van Leven (Paula van Dommelen, Elise Dusseldorp), de Universiteit van Leiden (Mark de Rooij) en het RIVM (Sandra van Dijk).

Bedankt ook aan al mijn GB-collega's! Wat is het fijn in zo'n leuke groep enthousiaste collega's te werken. De inhoud van een proefschrift is een ding, de kaft is ook niet onbelangrijk. Bilbo, bedankt voor je hulp bij de mooie kaft. Leon en Marja, voor jullie hulp bij alle regelzaken die nodig zijn om een proefschrift te kunnen schrijven. En Rik, bedankt voor zoveel onofficiële hulp (posterspreuken, statistiek, cola e.d.).

En dan mijn paranimfen Chantal en Jessica. Wat fijn dat jullie me tijdens mijn promotie bijstaan, zoals ik dat eerder mocht bij jullie promoties! Chantal, omdat we al vanaf ons zevende levensjaar als vriendinnen iedere levensfase samen meemaken, zou mijn promotie zonder jou als paranimf niet compleet zijn. Jessica, jij bent mijn beste GB-maatje. Bedankt voor alle gezelligheid! Astra, je bent dan wel geen paranimf, maar biedt wel iedere keer een luisterend oor en bent altijd in voor gezelligheid. Wat hebben we toch een fijne vriendschap.

Tenslotte, nergens beter af te schakelen van werk dan bij de familie Vogten thuis: Judith, Ron, en mijn neefjes Staf en Dylan. Wat een heerlijke hectiek en vrolijkheid heerst er toch bij jullie thuis! Pap en mam, bedankt voor zo'n fijne thuisbasis. Jullie vertrouwen en onvoorwaardelijke steun hebben me zover gebracht als ik hier vandaag sta. Ik weet dat jullie trots op me zijn.

En last but not least: Rob, bedankt voor alles! Voorlopig geen verre reizen meer in onze vrije tijd, maar kindvriendelijke vakanties met onze eigen kleine wondertje. Wat mooi dat we nu samen deze volgende fase ingaan. We hebben het toch goed samen!

Curriculum Vitae

Curriculum Vitae

Kathelijne Maria Hubertus Hubertus Bessems was born on October 29 1979 in Margraten, the Netherlands. After graduating from high school (Senior General Secondary Education) at the Euro College in Maastricht in 1997, she studied Social Work at Hogeschool Maastricht, from which she graduated in 2001. Subsequently she studied Health Education and Health Promotion at Maastricht University from 2001 to 2003. In 2003 Kathelijne started working as a research assistant, first at Commers Health Consulting and then at the Regional Public Health Service in Maastricht. From 2004 to 2006 she worked as a project officer for the Health Promoting Schools programme and several obesity prevention projects at the National Institute for Health Promotion and Disease Prevention (NIGZ) in Woerden. During the summer of 2006 she worked for three months as a volunteer at a Health Centre in Dakar, Senegal. In September 2006 she started working as a PhD-student at the Department of Health Promotion at Maastricht University, on a project regarding the dissemination of the healthy diet promotion programme Krachtvoer for prevocational schools. In 2011 she combined writing her thesis with teaching activities in the Bachelor and Master of Public Health. In November 2011 she started working as a postdoctoral researcher on a project regarding the nutrition education programme “Good food does not need to be expensive” for people with financial problems.

Publications

- Van Assema, P, Joosten, S, Bessems, K, Raaijmakers, L, De Vries, N, Kremers, S (2011). De omvang en aard van verkoopstrategieën gericht op kinderen bij voedingsmiddelen. *Tijdschrift voor Gezondheidswetenschappen*, 89 (2), 108-113.
- Bessems KMHH, Van Assema P, Paulussen TGWM, de Vries, NK (2011). Evaluation of an adoption strategy for a healthy diet programme for lower vocational schools. *Health Education Research*, 26 (1), 89-105.
- Raaijmakers, LGM, Bessems, KMHH, Kremers, SPJ, and Van Assema, P (2009). Breakfast consumption among children and adolescents in the Netherlands. *European Journal of Public Health*, 20 (3), 318-324.
- Leurs, MTW, Bessems, K, Schaalma, HP & de Vries, H (2007). Focus points for school health promotion improvements in Dutch primary schools. *Health Education Research*, 22 (1), 58-69.
- Bessems, K, de Ruiter, S, & Buijs, G (2006). *Toolkit Overgewicht. Preventie van overgewicht binnen de setting school*. Woerden: NIGZ.
- Bessems, K, Buijs, G & Leurs, M (2005). Gezondheidsprogramma's in de klas. Welke zijn slecht en goed? *Jeugd in School en Wereld*, 89 (9), 30-32.
- Bessems, K, Buijs, G, Leurs, M (2005). Gezondheidsprogramma's nader bekeken. Docenten en preventiefunctionarissen beoordelen de kwaliteit. *Jongleren*, 11 (1), 1-12.

Reports

- Bessems, K (2010). Werkblad beschrijving interventie Krachtvoer. Maastricht: Maastricht University, www.loketgezondleven.nl
- Bessems, K (2010). Factsheet resultaten Krachtvoer Schooljaar 2008-2009. Maastricht University.
- Bessems, K (2007). Resultaten van een kwalitatieve studie naar de ontwikkeling van de disseminatiestrategie Krachtvoer. Maastricht: Maastricht University.
- Bessems, K (red) (2005). SchoolSlag aanbod landelijk. Woerden: NIGZ.
- Bessems, K, Buijs, G, Leurs, M (2004). Kwaliteit onderwijsprojecten bepaald. Een toepassing van de schoolSlag-checklist 1.2. Woerden: NIGZ.